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100 PERCENT DESIGN SUBMITTAL

PLANS & SPECIFICATIONS FOR DNAPL RECOVERY SYSTEM

SOURCE CONTROL REMEDIAL ACTION

DETREX CORPORATION ASHTABULA, OHIO

Prepared for
Detrex Corporation
1100 State Road
Ashtabula, OH 44004

April 13, 2001

URS Corporation
800 West St. Clair Avenue
Cleveland, OH 44113
(216) 622-2400
38-08E06011.01

URS

April 13, 2001
38-8E06011.01

Submitted Via Federal Express

Ms. Terese Van Donsel
United States Environmental Protection Agency
Office of Superfund, Region 5
SR-6J
77 West Jackson
Chicago, IL 60604-3590

Subject: Transmittal of 100 Percent Design Submittal
Design Submittal for the DNAPL Recovery System
Detrex Source Control Area – Fields Brook Superfund Site - Ashtabula, Ohio

Dear Ms. Van Donsel:

In a letter dated February 7, 2001, USEPA provided comments on the 90% *Plans & Specifications for DNAPL Recovery System* for the Detrex Corporation Source Control Operable Unit. A *Response to Comments* document was issued to USEPA on March 16, 2001. On behalf of Detrex Corporation, URS Corporation (URS) is submitting six (6) copies of the attached *100 Percent Design Submittal* for your review and distribution. Text for the *Construction Quality Assurance Plan* will be submitted to your attention in the next several days.

We are proceeding with development of the *Remedial Action Work Plan* and look forward to your review of this submittal. If you have any questions, please do not hesitate to contact URS Corporation.

Sincerely,

URS

for Martin L. Schmidt, Ph.D.
Project Manager

Attachment

cc: Robert Currie – Detrex Corporation
Issa Shamiyeh - Detrex Corporation
Regan Williams – OEPA
Charles Guy - Detrex Corporation
Tom Steib - Detrex Corporation

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List of Acronyms

ASTM	American Society of Testing and Materials
CFR	Code of Federal Regulations
CR	Control Relay
DNAPL	Dense, Non-Aqueous Phase Liquid
GAC	Granular Activated Carbon
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HSO	Health and Safety Officer
LSA	Level Switch Alarm
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Administration
PLC	Programmable Logic Controller
RW	Recovery Well
SVE	Soil Vapor Extraction
UL	Underwriter's Laboratory
VGAC	Vapor Phase Granular Activated Carbon

PROJECT
SPECIFICATIONS

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes a summary of the work to be performed as described in this document. The work activities are to be performed in accordance with the specification contained herein, or any addendums issued pursuant to discussions during the bidding process, or any changes or modifications that were requested in writing by the selected contractor, and approved in writing by the Owner/Owner's Representative.

B. The work activities summarized in these specifications will be performed in general accordance with the schedule included as Attachment 1 of this document. Any changes in this schedule shall be requested in writing by the contractor and approved in writing by the Owner/Owner's Representative.

1.02 RELATED SECTIONS

All specifications, drawings and attachments contained in this document.

1.03 SUBMITTALS

Selected contractor will be required to submit a schedule for completion of the work activities described in this document. This schedule shall coincide with the milestone activities described in the schedule included in Attachment 1 of this document.

1.04 PROJECT DESCRIPTION

Detrex Corporation (the Site) is a chemical manufacturing facility located at 1100 State Road in Ashtabula, Ohio. The Site is approximately 0.50 miles east of State Route 11. A plume of Dense Non-Aqueous Phase Liquid (DNAPL) has been identified in the northeastern portion of the property. This condition is associated with former manufacturing operations that no longer take place at the property. The DNAPL is comprised of volatile and semi-volatile chlorinated organic compounds, including tetrachloroethene, 1,1,2,2-trichloroethane, hexachlorobenzene and hexachlorobutadiene. These materials pose recontamination concerns to sediments and surface in the DS Tributary, a surface stream located near the northern site boundary.

A. System Description

A pilot-scale, vacuum-enhanced DNAPL recovery system will be installed to remove readily recoverable DNAPL from the subsurface. A pilot-scale operation is proposed for a 1- to 2-year period to optimize the design of the full-scale system, The full-scale system will be approximately three times the size of the pilot-scale system and may differ in its design. The pilot DNAPL recovery system will include the following:

1. Twelve (12) vacuum-enhanced DNAPL recovery wells arranged in two lines of six wells each;
2. Two (2) Satellite Pumphouse Enclosures to house the air diaphragm pumps (P-101, P-102) that will recover the DNAPL, the manifold that will allow the pumps to pump wells individually or in a combined sequence, and vacuum splitter boxes that will allow the DNAPL recovery lines to be separated from the soil vapor extraction (SVE) vacuum lines to allow for installation of the pump manifold;
3. A secondarily contained Equipment Building that will house the air compressor for the air diaphragm pumps, the vacuum blower (B-102) and a DNAPL/water separator (T-101). The Equipment Building will also contain the electrical panels and programmable logic controller (PLC) for the DNAPL recovery system.
4. A secondarily contained DNAPL holding tank (T-102) will be located outside the Equipment Building. Canisters of vapor-phase granular activated carbon (GAC) will also be located outside of the building for treatment of exhaust from the vacuum blower (T-104, T-105) and vent emissions from the DNAPL/water separator and the DNAPL holding tank (T-106).

B. System Design and Logic

The system is designed to operate continuously, although all components of the system may not operate at a given time. Key design considerations include the density of the DNAPL (s.g. ~1.5), the low permeability of the subsurface materials, and the incompatibility of the DNAPL constituents with certain common construction materials, such as PVC.

1. The recovery wells will be constructed of stainless steel due to compatibility issues. The wells will be closely spaced due to the low permeability of the subsurface materials, which results in a relatively small radius of influence for a given well. A sustainable yield of DNAPL is not anticipated.
2. Air diaphragm pumps will be located in Satellite Pumphouse Enclosures to allow for pumping of multiple wells with a single pump. The pumps will be constructed of polypropylene or Kynar, which are compatible with the

DNAPL constituents. The enclosures, which are typically used for outdoor drum storage, will be constructed of HDPE, which is compatible with the DNAPL. The enclosures will allow for ready access to equipment and will also provide for secondary containment in the event of a leak.

3. Since a sustainable yield is not anticipated, dedicated well pumps are not required. Each air diaphragm pump will be manifolded to six wells. Electronic solenoid valves will control which well on the manifold is pumped at a given time. Each well will be pumped on a regular basis based on its production rate, as determined through operational monitoring data.
4. The air diaphragm pumps will be powered by an air compressor located in the Equipment Building. A 6-leg manifold will be connected to the compressor, and electronically actuated solenoid valves, controlled by the PLC, will allow the compressor to deliver air to one or more legs of the manifold. In the pilot-scale system, only two of the six legs will be used (one leg per air diaphragm pump).
5. The recovered liquid will be primarily DNAPL, but some fraction of groundwater may also be recovered. The liquid will be routed to the Satellite Pumphouse Enclosures in ½-inch diameter, high-density polyethylene (HDPE) tubing, which is compatible with the DNAPL. The liquid tubing will be located inside of 1.5-inch diameter HDPE tubing that will provide for secondary containment. The 1.5-inch diameter tubing will also serve to induce vacuum at the recovery well locations when the air diaphragm pump is not operational. The vacuum splitter boxes located within the pumphouse enclosures will allow for the DNAPL lines to be separated from the vacuum extraction lines while maintaining a vacuum on the system. The separation is necessary in order to individually connect the wells to the air diaphragm pump manifold. The discharge line from the air diaphragm pumps will be routed to the Equipment Building inside the vacuum extraction line leading from the splitter box. The Satellite Pumphouse Enclosures will provide for secondary containment of the DNAPL recovery lines when the recovery lines are split from the vacuum lines.
6. The "vacuum enhancement" aspect of the system is intended to accelerate the rate of recharge of DNAPL and groundwater to the recovery wells, thereby allowing the wells to be pumped more frequently and the overall yield of DNAPL to be increased. The vacuum induced by the SVE blower will pull against the suction end of the air diaphragm pump; consequently the SVE blower will not be operated on a given leg of the system when that air diaphragm pump is operational. The blower will induce vacuum on that leg when the pump is off, with the vacuum enhancement intended to accelerate the rate of well recharge.

7. The vacuum blower has been sized to pull approximately 100 standard cubic feet per minute (scfm) at 50" H_20 vacuum. Based on pilot test data, it is estimated that one leg of the system (six recovery wells) will produce approximately 100 scfm of soil vapor or less. The induced vacuum will produce a rise in groundwater levels; however, the vacuum should not be so great as to recover significant volumes of groundwater, which is not desirable. Groundwater and vapor condensate that are recovered will be removed in a moisture separator. The recovered vapors will pass through two vapor-phase granular activated carbon (GAC) canisters in series prior to discharge to the atmosphere. The GAC that has been specified (WATERLINK Barnebey Sutcliffe Type 208C 4x8 mesh) is considered effective for vapor-phase applications.
8. Liquid recovered by the air diaphragm pumps will be routed to a DNAPL/water separator located in the Equipment Building. Liquid from the SVE moisture separator will also be routed to the separator. The separator will be constructed of stainless steel due to potential compatibility issues with the DNAPL. Recovered DNAPL will drain by gravity to a secondarily contained holding tank located outside the Equipment Building. The vent lines from the separator and the holding tank will be routed through a vapor phase GAC canister to control emissions. The aqueous fraction from the separator will be decanted to a gravity drain line that will discharge to an existing storm sewer manhole located along the northern border of Detrex property. Influent to this storm sewer ultimately flows to the Detrex stormwater treatment system.

1.05 SCOPE OF WORK

A. Work activities include the following:

1. DNAPL Recovery Well Drilling and Installation – Completion of 12 direct push borings and 12 Phase I DNAPL recovery well installations along the northern border of Detrex property, and running north-south from the northern boundary of Detrex property.
2. Equipment Building Installation – Installation of the equipment building, including but not limited to the foundation and floor slab, all specified plumbing, pumping stations, valves and manifolds, blowers, filters, DNAPL/Water separator, DNAPL holding tank, and granular activated carbon treatment vessels.
3. Satellite Pump House Installation – Installation of 2 satellite pump houses, including but not limited to, all specified plumbing, pumps, valves and manifolds.
4. Plumbing and Hardware Connections – Installation of piping, braces and supports to connect the system together as shown in the attached design

drawings, and as described in this document, any addendums, or written and approved changes or modifications.

5. Power Supply – Installation of a power supply adequate to operate and maintain all components of the system.
6. Logic Controllers – Installation of a programmable logic controller for a the operation of the remediation system components.

B. The selected contractor will furnish all labor, supervision, permits, materials, equipment, tools, services and incidentals required to complete the Work required by these Specifications, Drawings, and attachments. The Work shall be as specified herein and as shown on the Drawings. After completion of the Work, and upon demobilization, the Contractor shall leave the Site free of Contractor's structures, equipment, and debris.

C. In general, work shall include, but not be limited to, the following:

1. Provide all warranties, bonds, insurance and other contract documents required.
2. Obtain all required permits.
3. Provide all required plans and documents, including, but not limited, to:
   a. Construction Schedule
   b. Contaminated Materials Handling Plan
   c. Quality Control Plan
   d. Health and Safety Plan
4. Furnish, as required, temporary facilities, utilities and site security.
5. Provide all project record drawings and other documentation as specified in this document.

1.06 SCHEDULE OF WORK

A. All work shall be scheduled and completed as noted in the Schedule, which is provided as Attachment 1.

B. The sequence and schedule of construction are subject to the approval of the Engineer and shall adhere, at a minimum to the following approximate milestones:

1. Contractor Selection ..... June 2001
2. Notice to Proceed ..... July 2001
3. Installation of DNAPL Recovery Wells ..... July 2001
4. Completion of DNAPL Recovery Wells, Equipment Building, Satellite Pump Houses and Demobilization ..... August 2001

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01010

SECTION 01020
SPECIAL PROJECT PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

This Section includes information regarding special procedures to be implemented as part of this design implementation. The special activities include those to address utilities, construction water management, public nuisance, health and safety, traffic control, and working hours.

1.02 RELATED SECTIONS

A. Section 01030 - Contractor Safety and Health
B. Section 01320 - Submittals

1.03 SUBMITTALS

A. The selected contractor will be required to submit documentation regarding these special procedures. All submittals shall be performed in accordance with Section 01320, unless noted elsewhere in these specifications.

B. All permits and permit correspondence required to performed the activities described in these documents shall be submitted to the Owner/Owner's Representative for review and approval at least 10 working days prior to submittal to the issuer of such permit.

1.04 UTILITIES

A. The Contractor shall verify the location of all utilities located within the areas of the Work and protect them from construction related activities, as specified in the Contract Documents. Should damage occur to an existing utility, the Contractor shall repair the utility at no cost to the Owner.

B. The enclosed drawings provide the locations of utilities known by the Owner/Owner's Representative to exist within the limits of work for this project. This identified utilities are not comprehensive. The selected contractor will be required to use caution during all earthwork activities performed.

1.05 CONSTRUCTION WATER MANAGEMENT

Water shall be managed using equipment and containers compatible with the contaminants identified on the site. The management of all construction derived materials shall be as described

in the Contractors Health and Safety Plan (HASP). The Contractor shall submit a copy of the HASP in accordance with specification 01030 of this specification.

1.06 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance during the execution of the work activities described in this document. Public nuisance activities include, but are not limited to, encroachment on adjacent lands not included within the limits of work identified on the design drawings or scope of work, flooding of adjacent lands, storing equipment in unapproved areas of the site, or excessive noise.

B. No extra charge may be made for time lost due to work stoppage resulting from the Contractor's creation of a public nuisance.

1.07 PERMITS

Where required under applicable regulations, the Contractor shall obtain and pay for all necessary permits, approvals and bonds. The Contractor shall advise the Owner/Owner's Representative in advance of his intention to conduct or attend any meetings, apply for any permits/approvals, or post any bonds with the governing agencies. The Contractor shall submit all acquired permits and copies of all his correspondence in accordance with item 1.03 of this specification, and Specification 01320 of this document.

1.08 TRAFFIC CONTROL

The Contractor shall:

A. Not cause traffic conflicts in the public roadway rights of way.
B. Designate construction personnel parking areas such that interference with public traffic is prevented and access for emergency vehicles are maintained.
C. Prevent parking on or adjacent to access roads or in non-designated areas.
D. Maintain all public non-truck routes in their pre-construction condition.
E. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.
F. Use lights to guide traffic during hours of low visibility.

1.09 WORKING HOURS

A. Regular working hours are defined as 7:00 a.m. to 6:00 p.m., Monday through Friday.

B. Requests to work other than regular working hours must be submitted in writing to the Owner/Owner's Representative, at least 72 hours prior to such proposed work, to give the Owner/Owner's Representative ample time to arrange for representation and/or inspection during those periods. Periodic unscheduled overtime on weekdays will be permitted provided that two hours notice is

provided to the Owner/Owner's Representative. Maintenance and cleanup may be performed during hours other than regular working hours subject to approval by the Owner/Owner's Representative and provided that it does not cause a nuisance to the public.

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01020

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes measurement and payment criteria applicable to the Work performed under a combined Lump Sum and Unit Price payment method.
B. This section includes methods for defect assessment and non-payment for rejected work.

1.02 RELATED SECTIONS

Measurement methods delineated in the individual specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the individual specification section shall govern.

A. Section 02675 – DNAPL Recovery Well Drilling
B. Section 02676 – DNAPL Recovery Well Installation
C. Section 02678 – Borehole and Well Abandonment
D. Section 03300 – Cast-In-Place Concrete
E. Section 13121 – Pre-Engineered Equipment Structures

1.03 AUTHORITY

The Contractor shall take all measurements and compute quantities. All payment item measurements shall be computed based on field survey of complete work, as finally accepted.

1.04 UNIT QUANTITIES SPECIFIED

A. Quantities and measurements indicated in the Bid Schedule are for bidding and contract purposes only. Quantities and measurements supplied or placed in the work and verified by the Owner/Owner's Representative will determine payment.
B. If the actual work requires more or fewer quantities than those quantities indicated, the Contractor shall provide the required quantities at the unit sum/prices contracted.

1.05 MEASUREMENT OF QUANTITIES

A. Measurement by volume: Measured by cubic dimension using mean length, width, and height or thickness.

B. Measurement by area: Measured by square, in-place, horizontal projection dimensions using mean length and width or radius.

C. Linear measurement: Measured by linear dimension, at the item centerline or mean chord.

D. Stipulated sum/price measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed items or unit of the Work.

1.06 NON-DIRECT PAYMENT

A. The Contractor is advised that while specifically required or called for by the Contract Documents, no direct payment will be made for:
   1. Special controls
   2. Dust control
   3. Supervision
   4. Home office support
   5. Equipment maintenance
   6. Construction photographs
   7. Laboratory testing
   8. Restoration of areas, outside the limits of work, damaged by the Contractor
   9. Protection of partially-completed work
   10. Health and Safety
   11. Survey
   12. Equipment decontamination
   13. Site security

The costs of this work, and any others not specifically identified, shall be included in the unit prices bid for the various items in the contract.

1.07 PAYMENT

A. Measurement and payment for items listed in Bid Schedule shall be as defined in the following bid items.

B. Item 1 - Insurance, Bonds, and Permits:

1. Basis of Measurement: Measurement of this item shall be the satisfactory acquisition of all required insurance, bonds, and permits that are required for the completion of the Work. Payment will be made at the Contract Lump Sum Price.
2. Basis of Payment: Payment may be made on a partial completion basis if approved by Owner/Owner's Representative.

C. Item 2 – Mobilization

1. Basis of Measurement: The measurement of this item shall be the completed delivery and setup of equipment and facilities, including, but not limited to:
   a. Delivery of Contractor required submittals for review and/or approval by the Owner/Owner's Representative.
   b. Attendance at the pre-construction meetings.
   c. Mobilization of all construction equipment, tools, and appurtenances staffed and ready for performing the Work.
   d. Delivery of materials and supplies needed for initiation of the Work but not included and paid elsewhere.
   e. Contractor required services, including, but not limited to electricity and sanitary services.
   f. Related costs associated with the installation of field offices.
2. Basis of Payment: Payment will be made at the Contract lump sum price as full compensation for all required work. Payment for this item cannot exceed two and one-half (2 ½) percent of the total bid price. Payment may be made on a partial completion basis if approved by Owner/Owner's Representative. Payment of this item will not be made until five (5) percent of the total of all items of work is complete and acceptable to the Owner/Owner's Representative and Owner/Owner's Representative. Delays and extensions of time shall not entitle the Contractor to additional compensation for this pay item.

D. Item 3 – Demobilization

1. Basis of Measurement: The measurement of this item shall be the completed removal of equipment and facilities including:
   a. All construction equipment,
   b. Temporary facilities and utilities, and
   c. Any other closeout activities not included for payment elsewhere.
2. The Contractor shall be paid for one demobilization only.
3. Basis of Payment: Payment under this item will be a lump sum as full compensation for performing all demobilization activities. This item shall not be more than one-half of one percent of the total bid price. Delays and extensions of time shall not entitle the Contractor to additional compensation for this pay item.

E. Item 4 – DNAPL Recovery Well Drilling

1. Basis of Measurement – The measurement for this item shall be the lineal feet drilled for DNAPL Recovery Well installation. In the event that a boring is abandoned and re-drilled at the direction of the Owner/Owner's Representative, the additional lineal feet drilled will be a pay item.
2. Basis of Payment – The unit bid price for this item shall be full compensation for furnishing all labor, materials and equipment required to complete all DNAPL Recovery Well borings as shown on the Contract Drawings. The unit price shall include all costs associated with completing the borings with personnel in the appropriate Level personal protective equipment, in accordance with Contractor's Health and Safety Plan.

F. Item 5 – DNAPL Recovery Well Installation

1. Basis of Measurement – The measurement for this item shall be the lineal feet of DNAPL well installed in accordance with the project requirements. Measurement shall be by footage of well material installed. All well fittings shall be included in the lineal foot unit price.
2. Basis of Payment – The unit price bid for this item shall be full compensation for labor and equipment to install the DNAPL Recovery Wells, in accordance with the project requirements. The price shall include, but not be limited to, stainless steel pipe risers, stainless steel foot valve, stainless steel cap, stainless steel well screen, connection to SVE tubing, sand pack, and bentonite seal.

G. Item 6 – Remediation System, Building and Concrete Pad

1. Basis of Measurement – The measurement for this item shall be a lump sum payment for installation of the Remediation System, Building and Concrete Pad in accordance with the project specifications.
2. Basis of Payment – The unit price for this item shall be full compensation for furnishing and installing all labor, material, and equipment to install the Remediation Building and Concrete Pad in accordance with the project specifications. The price shall include, but shall not be limited to:
   a. Concrete forms, concrete, and floor coating for secondary containment
   b. Plumbing (electric, hydraulic, and pneumatic) from the Satellite Pumphouse Enclosures to the Equipment Building
   c. Plumbing (electric, hydraulic, and pneumatic) supports between DNAPL recovery wells, Satellite Pump Houses, and the Remediation Treatment System Building,
   d. All Treatment System Plumbing (electric, hydraulic, and pneumatic),
   e. All other electrical conduits, wires, and associated appurtenances,

f. All control panels and logic controls

g. All DNAPL pumps, SVE blower, DNAPL/Water separator, DNAPL holding tank, granular activated carbon units, SVE Knock-Out Tank, valves, manifolds, and alarm systems.

H. Item 7 – Satellite Pump Houses

1. Basis of Measurement – The measurement for this item shall be a lump sum payment for installation of the Satellite Pump Houses in accordance with the project specifications.
2. Basis of Payment – The unit price for this item shall be full compensation for furnishing and installing all labor, material, and equipment to install the Satellite Pump Houses in accordance with the project specifications. The price shall include, but shall not be limited to, secondarily contained pump house structure, plumbing from DNAPL recovery well to the Satellite Pump House, internal plumbing, electrical, control panels, DNAPL Air Diaphragm Pumps, SVE Vacuum Box and DNAPL valve system.

I. Item 8 – Equipment Decontamination

1. Basis of Measurement – The measurement of this item shall be the satisfactory decontamination (including documentation) of all construction equipment prior to demobilization from the site and the maintenance and final cleanup of the Owner/Owner's Representative's decontamination pad.
2. Basis of Payment – Payment under this item shall be lump sum as full compensation for all required material, equipment, and labor required to perform the work. No progress payments will be made for this item. The lump sum shall be paid after all equipment is properly decontaminated and demobilized from the site and the decontamination pad is cleaned to the Owner/Owner's Representative's satisfaction.

J. Item 9 – Project Record Drawings

1. Basis of Measurement – The final measurement of this item shall be the satisfactory preparation, review, and submittal of project record drawings, in accordance with Section 01710.
2. Basis of Payment – Payment under this item will be a lump sum as full compensation for all required work, including record red-line drawings and supplemental record drawings. Progress payments will not be made on this item. The lump sum will be paid after the final drawings are accepted.

The price for this item shall not exceed a maximum of 2 ½ percent of the total bid price.

1.08 DEFECT ASSESSMENT

A. Replace the work, or portions of the work, not conforming to the specified requirements in the Drawings and Specifications.

B. If, in the opinion of the Owner/Owner's Representative, it is not practical to remove and replace the Work, they will direct one of the following remedies:
   1. The defective work may remain, but the unit sum/price will be adjusted to a new sum/price at the discretion of the Owner/Owner's Representative.
   2. The defective work will be partially repaired to the instruction of the Owner/Owner's Representative, and the unit sum/price will be adjusted to a new sum/price.

C. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction. If so, the recommendations of the inidividual specification will be used in lieu of this item.

D. The authority of the Owner/Owner's Representative to assess the defect and identify payment adjustment is final.

1.09 NON-PAYMENT FOR REJECTED PRODUCTS

Payment will not be made for any of the following:
A. Products wasted or disposed of in a manner that is not acceptable.
B. Products determined as unacceptable before or after placement.
C. Products not completely unloaded from the transporting vehicle.
D. Products placed beyond the lines and levels of the required work.
E. Products remaining on hand after completion of the work.
F. Loading, hauling, and disposing of rejected products.

PART 2 – PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION 01025

SECTION 01030
CONTRACTOR SAFETY AND HEALTH

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section specifies the minimum requirements for safety, health, and emergency response for the project. A site specific Health and Safety Plan (Site HASP) for the Detrex site has currently been prepared and is available for review by the Contractor.

B. The Contractor shall develop his own written Health and Safety Plan (Contractor HASP) to address health and safety issues related to the performance of work described in these specifications. The Contractor HASP shall also be developed to comply with all applicable federal, state, and local regulations.

1.02 RELATED SECTIONS

All Work related sections contained in this document.

1.03 SUBMITTALS

A. The Contractor shall submit two (2) copies of the Contractor HASP to the Owner/Owner's Representative at least 30 days prior to commencement of field activities. The Contractor HASP will be reviewed by the Owner/Owner's Representative to ensure that site specific Health and Safety issues have been addressed.

B. Contractor shall submit copies of current training certification statements, medical competence, and a statement of ability to wear a respirator for all personnel working at the Site. Such documentation should be included as part of the Contractor HASP.

C. Contractor shall submit copies of all Health and Safety related equipment servicing procedures, as stipulated by the equipment manufacturer, and copies of all equipment service performed to comply with the recommendations of said equipment manufacturer. This documentation shall be included as an attachment to the Contractor's HASP.

1.04 REGULATORY REQUIREMENTS

A. Work performed under this contract shall comply with applicable federal, state, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards 29 CFR Part 1910, especially Section .120, "Hazardous Waste Site

Operations and Emergency Response" and 29 CFR Part 1926, especially Section .65, "Hazardous Waste Site Operations and Emergency Response."

B. The program requirements of the OSHA Standards shall be integrated into a site-specific Health and Safety Plan (HASP). The HASP shall interface with the Contractor's overall Health and Safety Program. Any portions of the overall Health and Safety Program that are referenced in the HASP shall be included as appendices to the HASP.

C. The HASP shall be made available in accordance with 29 CFR Part 1910, Section .120 (b) (1) (v) and 29 CFR Part 1926, Section .65 9 (b) (1)(v).

1.05 HEALTH AND SAFETY PROGRAM

OSHA Standards 29 CFR Part 1910, Section .120 (b) and 29 CFR Part 1926, Section .65 (b) require employers to develop and implement a written Health and Safety Program for employees involved in hazardous waste operations.

1.06 TRAINING

All personnel shall receive training in accordance with the Contractor's written health and safety training program and 29 CFR Part 1910, Section .120, 29 CFR Part 1926, Section 65, and 29 CFR Part 1926 Section 21. At a minimum, all personnel shall have the minimum training described below:

A. General Operations Training:

1. Personnel entering the Exclusion or Contamination Reduction Zones shall have successfully completed 40 hours of hazardous waste instruction off the site; three (3) days actual field experience under the direct supervision of a trained, experienced supervisor; and 8 hours refresher training annually. Onsite supervisors shall have completed the above training and 8 hours of additional, specialized training covering at least the following topics: the employer's Health and Safety Program, personal protective equipment program, spill containment program, and health hazard monitoring procedures and techniques.
2. All employees who are required to supervise, standby, or enter permit-required confined spaces shall have been trained as specified by 29 CFR Part 1910, Section .146. Persons involved in any aspect of the transportation of hazardous materials shall be trained in accordance with 49 CFR Part 172, Subpart H.

B. Site-Specific Training:

Prior to commencement of onsite field activities, all site personnel, including those assigned only to the Support Zone, shall attend a site-specific health and safety briefing. The Health and Safety Manager and the Site Health and Safety Officer shall conduct this session to ensure that all personnel are familiar with

requirements and responsibilities for maintaining a safe and healthful work environment. Procedures and contents of the accepted HASP shall be thoroughly discussed for documentation purposes, a roster sheet shall be completed which contains the names and signatures of all participants. The Owner/Owner's Representative and Owner/Owner's Representative shall be notified at least five days prior to the initial site-specific training session so personnel involved in the project may attend.

C. Periodic Sessions

The Site HSO shall conduct a daily briefing for personnel assigned to work at the site. The briefing shall address safety and health procedures, work practices, any changes in the HASP, activity hazard analyses, work tasks or schedule, results of previous week's air monitoring, review of safety discrepancies, and accidents. Should an operational change affecting onsite fieldwork be made, a meeting prior to implementation of the change shall be convened to explain health and safety procedures. The Site HSO, using the training curriculum outlines developed by the Health and Safety Manager, shall conduct site-specific training sessions for new personnel, visitors, and suppliers. All sessions shall be documented by completion of roster sheets.

1.07 PPE For Owner/Owner's Representative/Regulatory Agency Personnel

Clean sets of personal protective equipment and clothing (excluding air-purifying respirators and safety shoes, which must be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, shall be available for use by the Owner/Owner's Representative or official visitors. The items shall be cleaned and maintained by the Contractor. The Contractor shall provide basic training in the use and limitations of the PPE provided, and institute administrative controls to check prerequisites prior to issuance. Such prerequisites include meeting minimum training requirements for the work tasks to be performed and medical clearance for site hazards and respirator use.

1.08 Certificate of Worker/Visitor Acknowledgment

A Contractor-generated certificate of worker/visitor acknowledgment shall be completed and submitted for each visitor allowed to enter Contamination Reduction or Exclusion Zones, and for each employee. An example copy of this certificate has been included following the end of this section.

PART II - PRODUCTS

2.01 Not used.

PART III - EXECUTION

3.01 Not used.

END OF SECTION 01030

EXAMPLE CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGMENT

CONTRACT NO.: _____

PROJECT NAME: _____

PROJECT ADDRESS: _____

CONTRACTORS NAME: _____

EMPLOYEES/VISITORS NAME: _____

The contract for the above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in their use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you.

I HAVE READ, UNDERSTAND, AND AGREE TO FOLLOW THE SITE HEALTH AND SAFETY PLAN FOR THIS SITE.

Name _____ Date _____

FORMAL TRAINING: I have completed the following training courses that meet the OSHA "HAZWOPER" requirements.

	Date Completed
40-Hour	_____
8-Hour Supervisory	_____
8-Hour Refresher	_____

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this contract. The Site Health and Safety Officer conducted the training.

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in the Contractor's/my employer's Respiratory Protection Program. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will wear. I will abide by policies concerning eyeglasses, contact lenses, and facial hair.

SECTION 01210
PROJECT MEETINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Owner or Owner's Represent shall schedule and administer a pre-construction conference, periodic progress meetings, and specially called meetings throughout the progress of the work and shall:
   1. Prepare agenda for meetings
   2. Preside at meetings
   3. Prepare and distribute meeting minutes

B. The Owner or Owner's Representative, Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

D. The Contractor shall arrange and conduct Health and Safety briefings as described in the Health and Safety Plan.

1.02 RELATED SECTIONS

A. Section 01030 – Contractor Safety and Health

B. Section 01700 – Work Closeout

C. Section 01710 – Project Record Documents

1.03 PRECONSTRUCTION CONFERENCE

A. The Contractor shall attend a scheduled pre-construction conference.

B. The location of the pre-construction meeting shall be at the Detrex Corporation. facility in Ashtabula, Ohio.

C. Parties responsible for attending the preconstruction meeting are:
   1. The Owner
   2. Owner's Representative
   3. The Contractor's Superintendent, Site Health and Safety Officer, and others, as appropriate
   4. Major subcontractors
   5. Regulatory agency personnel, as required
   6. Others as appropriate

D. The purpose of the pre-construction conference will be to establish relationships among all parties involved in the remedial action, including lines of communication, lines of authority, and scope of work. The suggested agenda is as follows:

1. Distribution and discussion of:
   a. List of major subcontractors and suppliers
   b. Projected construction schedules
2. Critical work sequencing
3. Major equipment deliveries and priorities
4. Project coordination
5. Designation of responsible personnel
6. Procedures and processing of:
   a. Field decisions
   b. Proposal requests
   c. Submittals
   d. Change Orders
   e. Applications for Payment
7. Adequacy of istribution of Contract Documents
8. Procedures for maintaining record documents
9. Use of premises:
   a. Office, work and storage areas
   b. Coordination with the Owner's operations
10. Construction facilities, controls and construction aids
11. Temporary utilities
12. Housekeeping procedures
13. Check of required bond and insurance certifications
14. Liquidated damages
15. Laboratory testing of material requirements
16. Inventory of material stored on site provisions
17. Verification of cleanup and change orders for additional work
18. Health and Safety Plan
19. Construction Quality Assurance
20. Public relations issues
21. Coordination with local governments
22. Permitting requirements
23. Access issues

1.04 PROGRESS MEETINGS

A. Contractor shall schedule regular progress meetings. The progress meetings will be held every 14 days or less with the first meeting 14 days after the pre-construction meeting or 14 days or less after the date of Notice to Proceed.

B. Contractor or Owner will hold specially called meetings as required by progress of the Work.

C. Location of the meetings: Detrex facility or the Contractor's field office.

D. Attendance:
   1. The Owner
   2. Owner's Representative
   3. Regulatory Agency personnel, if applicable
   4. Contractor's Superintendent, Health and Safety Officer, and others as appropriate
   5. Subcontractors as appropriate to the agenda
   6. Suppliers as appropriate to the agenda
   7. Others as appropriate

E. Suggested Agenda:
   1. Review, approval of minutes of previous meeting
   2. Review of work progress since previous meeting
   3. Field observations, problems, conflicts
   4. Problems that impede the construction schedule
   5. Review of off-site fabrication, delivery schedules
   6. Corrective measures and procedures to regain projected schedule
   7. Revisions to construction schedule
   8. Progress, schedule, during succeeding work period
   9. Coordination of schedules
   10. Review submittal schedules; expedite as required
   11. Maintenance of quality standards
   12. Pending changes and substitutions
   13. Review proposed changes for effect on construction schedule and completion date
   14. Matters related to Health and Safety Plan and emergency response and contingency planning
   15. Quality assurance procedures
   16. Public relations
   17. Other business

F. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, and progress of the work.

G. The Owner or Owner's Representative shall keep an accurate account of all meetings in a "meeting minutes" form and distribute to the attendees within five (5) days of the meeting.

1.05 SUBMITTALS

A. Contractor shall submit one (1) original and two (2) copies of the construction schedule to the Owner or Owner's Representative before each progress meeting:

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01210

SECTION 01320
SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section describes the procedures to be used to submit information to the Owner/Owner's Representative. In general, all equipment, materials, subcontractors, work activities and other components of this project are subject to the acceptance of the Owner/Owner's Representative. Except where stated in this document, no materials or appurtenances intended for use shall be accepted until documentation regarding the acceptability of the materials or equipment are submitted for approval by the Owner/Owner's Representative. Such acceptance shall be made in writing.

B. The Contractor shall submit to the Engineer for review, working drawings, proposed products, test reports and data on materials (hereinafter in this Section called data), material samples (hereinafter in this Section called samples), subcontractor qualifications, and other miscellaneous submittals as determined by the Owner/Owner's Representative, as are required for the proper control of work. These submittals shall include but not be limited to, those working drawings, data and samples for materials specified elsewhere in the specifications and in the Drawings.

C. The Contractor shall note that there are specific submittal requirements in other sections of these specifications.

The Contractor shall retain on-site, a complete file on submittals and any other construction information and data for review by the Owner and the Owner's representatives.

1.02 RELATED SECTIONS

A. All Division 2, Division 15, and Division 16 specifications contained in this document

1.03 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Contractor's or subcontractor's shop drawings made specifically for this project, for use in fabrication and installation as specified in the Contract Documents.
   1. Shop drawings must show sufficient data, including layout, fabrication and erection details to establish evidence of compliance with the Contract Documents.
   2. Do not use reproductions of Contract Drawings as shop drawings unless specifically permitted in the Contract Documents.

3. Identify details by reference to sheet and detail numbers shown on Contract Drawings and by reference to paragraphs and specification section.

B. Manufacturer's Standard Schematic Drawings
   1. Modify drawings to delete information that is not applicable to project.
   2. Add supplemental information applicable to project.

C. Manufacturer's product data catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.
   1. Clearly mark each copy to identify materials, products, or models applicable to this project.
   2. Show colors when required for evaluation, record, or other purpose. Where product data is printed in color, submit all copies in original colors as published.
   3. Show dimensions and clearances required.
   4. Show performance, characteristics, and capacities.

D. Samples - Actual samples of products proposed for use. Samples must be of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material, with integral related parts and attachment devices.
   2. Full range of color, texture, and patterns.

1.04 PROPOSED PRODUCT LIST

A. Within 30 days from execution of the agreement between Owner and Contractor, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade names, model or catalog number, and reference standard.

1.05 MISCELLANEOUS SUBMITTALS

A. Construction Permits:
   1. Acquire, maintain, and submit copies of all construction permits that are required by the agencies to execute the Work.

B. Manufacturers' Instructions:
   1. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting and finishing in quantities specified herein.
   2. Identify conflicts between manufacturers' instructions and Contract Documents.

C. Manufacturers' Certificates:

1. When specified in individual specification Sections, submit manufacturers' certificates to Engineer, in quantities specified herein.
2. Indicate that a material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
3. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer. If these are outdated and/or not acceptable to Engineer, the Contractor shall submit to the Engineer the new certificates and test results on materials or product.

D. Test Reports:

1. Classify each as either "project related" or Product Data, depending upon whether report is uniquely prepared for project or a standard publication of workmanship control testing at point of production, and process accordingly.
2. All test equipment used shall be verified to be in calibration at the time of each test and test reports shall so indicate. No test shall be made without such verification.

1.06 SUBMISSION REQUIREMENTS

A. Submit a detailed shop drawing schedule at least 20 days before submission of any shop drawing.

B. Use "Submittal Summary" (see sample at end of this Section) or facsimile as cover sheet for each submittal. The "Submittal Summary" is not intended to take the place of the Contractor's letter of transmittal; but should accompany each individual specification section submittal separately. Do not combine submittals of more than one (1) product or section.

C. Allow at least 30 days for review process, before approved submittals are needed.

D. Submit six (6) copies of each shop drawing.

E. Submit six (6) copies of product data.

F. For sample selections, submit one (1) set. For sample approval, submit three (3) sets.

G. Where product data is printed in color and requires color for evaluation, record, or other purpose, all copies submitted shall be in original colors as published.

H. In addition to information required on the "Submittal Summary", submittals shall include:

1. Relation to adjacent materials.
2. Field dimensions, clearly identified as such.
3. Finishes.
4. Shipping weights.
5. Applicable standards, such as ASTM or Federal Specification numbers.
6. A blank space, 3 inches x 10 inches for the Engineer's submittal stamp.
7. Contractor's stamp, initialed or signed, certifying approval of submittal, verification of field measurements, coordination with all trades involved and compliance with Contract Documents. The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Engineer's approval of shop drawings, product data or samples unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submission and the Engineer have given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data, or samples by the Engineer's approval thereof.

1.07 SUBMITTAL REVIEW

A. If Contractor does not review submittals before sending them to the Engineer, they will be returned unchecked.

B. The Engineer will review for conformance to the design concept of the Project and the information in the Contract Documents. The Engineer's review of separate items does not constitute review of an assembly in which item functions.

C. The Engineer will return submittals to Contractor with approval for distribution or directions to correct and resubmit. Submittals will be marked as follows:

1. NO EXCEPTIONS TAKEN - The work involved may proceed, and no further submission is required.
2. FURNISH AS NOTED - The work involved may proceed providing submittal is corrected and resubmitted for record.
3. REVISE AND RESUBMIT - The work involved may not proceed. Submittal must be corrected and resubmitted.

D. The Engineer shall review a submittal/re-submittal a maximum of three (3) times after which the cost of the Engineer's review shall be borne by the Contractor.

1.08 RESUBMISSION REQUIREMENTS

A. Identification of Changes - Clearly identify changes made from the initial submittal.

B. Make resubmittals as specified under Paragraph 1.6.

1.09 DISTRIBUTION OF APPROVED SUBMITTALS

A. Contractor shall reproduce and distribute copies of submittals having the Engineer's stamp to:

1. Contractor's file
2. Job-site file
3. Record document file
4. Subcontractors
5. Engineer

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01320

SUBMITTAL SUMMARY

Project Name: Detrex Corporation DNAPL Recovery System

Location _____

Reference Specification No. _____

Submission No. _____

Date of Submission _____

Item Submitted _____

_____

Contractor _____

_____

Subcontractor _____

_____

Supplier/
Manufacturer _____

_____

Deviations from Contract Documents: (Describe in Detail) (If there is no deviation from Contract Documents, state "No Deviations").

SECTION 01510
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes specification items to be used for the installation of temporary utilities at the project site during the remedial work activities. Temporary utilities may be required during the construction to provide services to the employees working at the site.

B. All temporary utilities shall meet applicable codes for their construction and use as specified in this document, applicable trade journals, and state and local codes and ordinances.

1.02 RELATED SECTIONS

A. Section 01030 - Contractor Safety and Health

B. Section 01590 - Field Offices and Temporary Facilities

1.03 REFERENCES

National Electric Code (Latest Edition)

1.04 TEMPORARY ELECTRICITY AND LIGHTING

A. Contractor shall arrange with Owner and the local utility company to obtain electrical service required for power and lighting. Contractor will be responsible for payment of all costs associated with installation, maintenance, and removal of temporary electrical service. Owner will provide payment for service costs.

B. Electrical power may be used to power field offices, decontamination trailers and ancillary equipment associated with construction activities and site security.

1.05 TEMPORARY TELEPHONE SERVICE

A. Telephone service will be available at the Detrex Corporation offices for emergency use only.

B. If necessary, Contractor can arrange with the local telephone service company to provide direct line telephone service to field office trailers.

C. If temporary telephone service is installed, Contractor will be responsible for payment of all costs for installation, maintenance and removal, and service charges for local calls and toll charges.

1.06 TEMPORARY WATER

A. Owner will allow Contractor the use of existing potable and non-potable process water (ASHCO water) for Contractor's use. Contractor shall be responsible for connection to water supplies and routing of the water to the work area.

B. The quantity of water required for equipment and personnel decontamination, dust control, and other site activities shall be determined by the Contractor. Non-potable water outlets, if any, such as for fire fighting purposes, shall be clearly identified, indicating that the water is unsafe, and is not to be used for drinking, washing, or cooking purposes.

C. The Contractor shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees.

1.07 TEMPORARY SANITARY FACILITIES

A. Contractor will provide sanitary facilities for his workers in compliance with laws and regulations.

B. Contractor shall be responsible for the servicing, cleaning, and maintenance of temporary sanitary facilities and enclosures.

C. Contractor will be responsible for all costs associated with the maintenance of temporary sanitary facilities.

1.08 MAINTENANCE

A. Contractor shall be responsible for maintenance and operation of all temporary utilities during use.

B. Contractor shall be responsible for any modifications to temporary utility appurtenances, ensuring compliance with all regulations, and ensuring a safe operation in accordance with the Site Health and Safety Plan and Section 01030 of this document.

1.09 REMOVAL

A. Contractor shall completely remove all temporary utility materials and equipment when their use is no longer required at project completion.

B. Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities and restore site to pre-construction conditions or better.

PART 2 - PRODUCTS

2.01 Not Used.

PART 3 - EXECUTION

3.01 Not Used.

END OF SECTION 01510

SECTION 01540
SECURITY

PART 1 – GENERAL

1.01 SECTION INCLUDES

This section includes specifications for site security during construction activities. The project work area is located in a secure portion of the facility and will be maintained as a secure area for the duration of construction activities performed on-site. Contractor shall maintain site security in accordance with this specification and Detrex site security requirements.

1.02 RELATED SECTIONS

Section 01030 - Contractor Safety and Health

1.03 CONSTRUCTION SITE ENTRANCE CONTROL

A. Contractor shall maintain control of all persons and vehicles entering and leaving the Construction Site, as necessary, to assure integrity of the project and safety. Contractor shall exclude all personnel not properly identified and/or approved for entry.

B. The Contractor shall maintain identification of all construction site workers (including subcontractors), which will include, at a minimum, name, and employer.

C. The Contractor shall maintain a current list of persons approved for access to the construction site.

D. The Contractor shall require personnel to sign in upon entering the construction site and to sign out when leaving.

E. The Contractor shall maintain a list of all vehicles entering and leaving the construction site.

F. No visitors shall be allowed in the construction area without the prior approval of the Owner/Owner's Representative. Visitors shall comply with the requirements of Section 01030 – Contractor Health and Safety, and shall not be left unescorted.

G. The Contractor shall maintain a log of all visitors that shall include name, affiliation, and purpose of visit.

H. The Contractor shall require signature of visitors on a form relieving the Owner/Owner's Representative, their officers, employees, and agents of the

liability of consequences related to potential hazards associated with construction site entry.

1.04 CONSTRUCTION SITE CONTROL

A. General

1. Owner maintains security and access to the manufacturing portions of the site at all times. Construction activities will occur inside of the Owner-secured manufacturing portions of the site. Reasonable measures to aid in securing these areas from unauthorized entry will be the responsibility of Contractor.
2. Maintain control of the construction site and assume responsibility for security. At a minimum, provide security during all working hours (construction operation). Security procedures shall be established on site to log in/log out working personnel at the beginning of each working day and to log out working personnel at the end of each working day.

B. Security Personnel

1. Provide sufficient personnel to accomplish the security measures outlined in these specifications. The Owner/Owner's Representative shall have the right to approve and reject the personnel assigned to the project site at any time during Contractor activities.
2. The Contractor shall ensure that all personnel whose job description includes site security have received training as specified in Section 01030 and the Site Health and Safety Plan.
3. The Contractor shall conduct coordination visits as needed with local law enforcement and emergency service officials (i.e., state police, emergency medical corps units, fire departments, and utility emergency teams) to map out contingency plans for emergency situations.

1.05 SUBMITTALS

A. Submit one (1) original and two (2) copies of the current list of accredited persons and subcontractors permitted on the project site to the Owner/Owner's Representative on request.

B. Submit one (1) original and two (2) copies of the daily personnel visitor and vehicle logs to the Owner/Owner's Representative weekly upon request.

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01540

SECTION 01560
ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The requirements of this Section are intended to apply to pollutants that are generated during the construction process. The Contractor shall perform all Work in such a manner as to minimize the pollution of air, water or land during, and as the result of, construction operations under this Contract.

B. For the purpose of these Specifications, environmental pollution is defined as: The presence of chemical, physical or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and recreational purposes. Pollution from materials at the Site, contacted during construction, must also be minimized.

1.02 RELATED SECTIONS

A. Section 01020 - Special Project Procedures

B. Section 01030 - Contractor Safety and Health

C. Section 02130 – Contaminated Materials Handling

D. Section 02675 – DNAPL Recovery Well Drilling

E. Section 02676 – DNAPL Recovery Well Installation

1.03 SUBMITTALS

A. Contractor Health and Safety Plan

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.01 PROTECTION OF LAND AREAS

A. It is intended that the land resources within the project boundaries and outside the limits of permanent work performed under the Contract be preserved in their present condition. The Contractor shall confine his construction activities to areas defined by the Drawings and these Specifications.

B. In order to minimize erosion, Contractor shall restore surface cover to match or exceed existing conditions in areas that are disturbed by Contractor's work.

3.02 PROTECTION OF WATER RESOURCES

A. The Contractor shall not pollute streams or other water resources, such as Fields Brook or the DS Tributary. The Contractor shall assure the proper handling and disposal of fuels, oils, slurry mixes, or other potentially harmful construction related materials. It is the Contractor's responsibility to investigate and comply with all applicable federal, state, county and municipal laws concerning pollution of rivers, streams or other water resources. All work shall be performed in such a manner that objectionable conditions at or adjacent to the Project area are minimized.

B. Water used on-site shall not be allowed to enter a stream or other water resource. If any material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the surrounding undisturbed area. If necessary, contaminated ground shall be excavated, disposed of and replaced with suitable fill material compacted and finished with vegetative soil or stone cover at the Contractor's expense.

3.03 STORAGE FACILITIES

At the completion of use, restore storage locations to the original conditions prior to construction as documented in the Pre-Construction Survey or better. Restoration shall commence as soon as the locations are no longer needed for storage purposes.

3.04 HAULING MATERIAL ON STREETS

A. When it is necessary to haul material over streets or pavements, the Contractor shall provide suitable vehicles so as to reduce deposits on the streets or pavements. The Contractor is responsible for insuring that vehicles leaving the Site are clean of dirt and debris. In all cases where any materials are dripped from the vehicles, the Contractor shall clean up the same to keep the streets and pavements free from dirt, mud, stone, or other hauled material. The Contractor is responsible for obtaining all state, county, and local permits to allow transport of any and all materials or equipment on public roadways.

B. The Contractor is responsible for repair of damage to public and private roadways that result from the transport of material to the Site.

3.05 BURNING

No burning of discarded construction lumber or other materials shall be permitted on-site.

3.06 TRASH AND DEBRIS DISPOSAL

A. Except as specifically noted in the Contract Documents, all debris/waste generated as a result of construction operations, shall be removed from the site and disposed of off-site. This shall be accomplished daily, or as directed by the Owner/Owner's Representative.

B. Contractor must maintain general cleanup practices.

3.07 CORRECTIVE ACTION

The Contractor shall, upon receipt of notice in writing from the Engineer, of any noncompliance with the foregoing provisions, take immediate corrective action as specified in the Contract Documents at no additional cost to the Owner.

3.08 POST-CONSTRUCTION CLEANUP/REMOVAL

The Contractor shall, unless otherwise instructed in writing by the Engineer, cleanup and remove all temporary construction facilities, work areas, stockpiles of excess materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded. Any off-site damage attributable to the Contractor's performance of work shall be repaired at no additional cost to the Owner.

END OF SECTION 01560

SECTION 01590
FIELD OFFICES AND TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Furnishing and maintaining of field offices, storage sheds and other temporary facilities.

1.02 RELATED SECTIONS

A. Section 01030 - Contractor Safety and Health

B. Section 01510 - Temporary Utilities

1.03 EXISTING FACILITIES

A. There are no existing office facilities at the site for Contractor use during construction. There are areas for storage of equipment and materials. These areas will be designated during the pre-construction meeting.

B. Electrical power supply is available, but will have to be extended by Contractor to equipment and contractor offices. The Owner will pay for monthly service fees for electricity.

C. Potable and non-potable water supplies are available, but will have to be extended by Contractor to Contractor's offices and equipment. These supplies may be used at the point-of-origin with Owner's pre-approval.

PART 2 - PRODUCTS

2.01 GENERAL

Field offices and equipment to be used on-site by the Contractor shall be adequate for purposes for which intended and must meet applicable codes and regulations.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed, with steps and landings at each entrance door. Steps shall conform to the requirements stated in 29CFR1910.24 "*Fixed Industrial Stairs.*"

B. Thermal resistance of floors, walls, and ceilings shall be as appropriate for occupancy and storage requirements.

C. Interior office materials shall consist of sheet-type materials for walls and ceilings, pre-finished or painted and resilient floors and bases.

D. Lighting for offices shall produce a minimum illumination of 50 ft-candles at desktop height. Exterior lighting shall be required at entrance doors. All lighting shall comply with the Illuminating Engineering Society of North America (IES) Lighting Handbook.

E. The Contractor shall provide an appropriate type fire extinguisher at each office and each storage area.

F. Interior materials in storage areas shall be as required to provide specified conditions for storage of products.

2.03 ENVIRONMENTAL CONTROL

Heating, cooling, and ventilation for offices shall consist of automatic equipment to maintain ambient inside temperatures of 72 °F. when cooling, and 68 °F. when heating.

2.04 CONTRACTOR OFFICE AND FACILITIES

Contractor shall determine size, furnishings, equipment, and facilities for his own use.

2.05 EMPLOYEE SHELTERS

A. Contractor shall provide area(s) where employees can eat, drink and relax.

B. Personnel will be required to remove their contaminated clothing and to wash their hands before entering the lunch or break area. (Refer to Health and Safety Plan).

C. Heating and/or ventilation for storage buildings shall be as needed to maintain products in accordance with the Contract Documents.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installation of field offices, storage sheds and other temporary facilities, the Contractor shall confirm his selected location(s) with the Owner/Owner's Representative.

B. Approved locations for field offices, storage sheds and other temporary facilities shall be filled, compacted, and graded to provide drainage away from buildings.

3.02 INSTALLATION

A. The Contractor shall install office buildings and other buildings in accordance with local codes and be ready for occupancy 15 days before the start of work activities.

B. At a minimum (and subject to local codes), trailers shall be placed on blocks, leveled and secured with tie-down straps.

3.03 MAINTENANCE AND CLEANING

A. Contractor shall provide janitorial services on an as-needed basis for temporary structures, access areas, and work areas. Janitorial personnel must be health and safety briefed, as appropriate.

B. The Contractor shall maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

At completion of Work, the Contractor shall remove buildings, foundations, utility services, and debris, as well as, restore areas to original conditions that are acceptable to the Owner/Owner's Representative.

END OF SECTION 01590

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section includes procedures for the transportation, handling, storage, and protection of materials and equipment to be used for this project.

1.02 RELATED SECTIONS

A. 01320 - Submittals

B. Division 2 – Site Work

C. Division 3 – Concrete

D. Division 15 - Mechanical

E. Division 16 – Electrical

1.03 PRODUCTS

A. Products: New material, machinery, components, equipment, fixtures, and systems for performing the work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.

B. The Contractor may provide interchangeable components of the same manufacturer, or similar components from a different manufacturer with approval of the Owner/Owner's Representative.

1.04 TRANSPORTATION AND HANDLING

A. The Contractor shall transport and handle products in accordance with manufacturer's instructions.

B. The Contractor shall promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.05 STORAGE AND PROTECTION

A. The Contractor shall store and protect products in accordance with manufacturer's instruction, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight, climate-controlled enclosures.

B. Fabricated products stored outside shall be stored placed on sloped supports, above ground.

C. The Contractor shall provide off-site storage and protection when site does not permit on-site storage or protection.

D. The Contractor shall cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. The Contractor shall store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. The Contractor shall provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. The Contractor shall arrange storage of products to permit access for inspection. Products shall be periodically inspected to assure products are undamaged and are maintained under specified conditions.

H. The Contractor is responsible for replacing all materials damaged due to improper storage and handling at Contractor's sole expense. Under no circumstances shall damaged materials be installed.

1.06 PRODUCT OPTIONS

A. Products specified by reference standards or by description only: Any product meeting those standards or description.

B. Product Specified by Naming One or More Manufacturers: Product of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Product Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Substitutions for "or equal" products shall be as specified in the Contract Documents and the Instruction to Bidders. In general, any substitution shall require the written approval of the Owner/Owner's Representative.

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01600

SECTION 01700
WORK CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section describes procedures top be used for work closeout.

B. Comply with requirements stated in Contract Documents and in specifications for administrative procedures in closing out the Work.

C. Perform final site cleanup and decontamination of equipment and materials.

D. Disconnect and remove temporary utilities and facilities.

1.02 RELATED SECTIONS

A. Section 01030 Contractor Safety and Health

B. Section 01020 Special Project Procedures

C. Section 01510 Temporary Utilities

D. Section 01710 Project Record Documents

1.03 PRE-FINAL (PRE-CERTIFICATION) INSPECTION

A. When the Contractor considers the Work substantially complete, he shall submit to the Owner/Owner's Representative for review and comment:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. Draft project record documents required by Section 01710 and all items required by the Specifications to be submitted at completion of construction.
3. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Owner/Owner's Representative and agencies with a jurisdictional interest shall make an inspection to determine the status of completion. The purpose of the inspection will be to determine if all aspects of the plans and specifications have been implemented at the Site, and that the remedy is operational and functional.

C. Should the Owner/Owner's Representative determine that the work is not substantially complete:

1. The Owner/Owner's Representative will promptly notify the Contractor in writing with a punchlist that details the outstanding items requiring completion or correction prior to acceptance of work.
2. The Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Owner/Owner's Representative.
3. The Owner/Owner's Representative shall reinspect the work.

D. When the Owner/Owner's Representative finds that the work is substantially complete, he shall:

1. Prepare and deliver to the Contractor a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final payment.

E. When the Owner/Owner's Representative considers the work substantially complete, he shall:

1. Execute and deliver to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.04 FINAL INSPECTION

A. When the Contractor considers the work complete, he shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Cleanup has been satisfactorily verified and is complete.
5. Work is completed and ready for final inspection.

B. The Owner/Owner's Representative shall make an inspection to verify the status of completion with reasonable promptness after receipt of such certification. All items indicated on the punchlist shall be reinspected and all tests that were originally unsatisfactory shall be conducted again.

C. Should the Owner/Owner's Representative consider that the work is incomplete or defective:

1. The Owner/Owner's Representative shall promptly notify the Contractor in writing. A final punchlist shall be developed for any outstanding deficiencies requiring correction.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Owner/Owner's Representative that the work is complete.
3. The Owner/Owner's Representative shall reinspect the work.

D. When the Owner/Owner's Representative finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 REINSPECTION FEES

A. Should the Owner/Owner's Representative perform more than one reinspection due to failure of the work to comply with the claims of status of completion made by the Contractor:

1. The Owner shall deduct the amount of all costs associated with reinspections from the final payment to the Contractor.

1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS TO OWNER/OWNER'S REPRESENTATIVE

A. The Contractor shall submit the final Record Documentation including record and supplemental record drawings in accordance with Section 01710 – Project Record Documents. Final payments and project close out shall not be made until this documentation is submitted by the Contractor and approved by the Owner/Owner's Representative.

B. The Contractor shall prepare a written statement which certifies that all items contained in the Contract Documents have been completed and that the final cover system is operational and functional.

C. The Contractor shall submit evidence of Payment and Release of Liens.

D. The Contractor shall submit an application for Final Payment (retainage).

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 DECONTAMINATION

A. Without exception, all recoverable Contractor owned equipment and materials shall be decontaminated by the Contractor prior to final removal from the Site.

B. Decontamination shall take place within the equipment and materials decontamination area designated in these specifications and the Contractor Health and Safety Plan. Decontamination shall consist of de-greasing (if required) followed by high pressure, hot water cleaning supplemented by detergents as appropriate. Special attention shall be paid to removal of material on and within the tracks and sprockets of crawler equipment, and the tires and axles of trucks and rubber mounted equipment.

3.02 FINAL APPROVAL

A. Prior to removal from Site, all decontaminated equipment and materials shall be inspected and approved by the Owner/Owner's Representative.

B. Certification of decontamination shall be attested to by the Site Health and Safety Officer.

C. A copy of each decontamination certificate shall be provided to the Owner/Owner's Representative, and the Contractor's Site Health and Safety Officer.

3.03 TEMPORARY UTILITIES

A. Temporary utilities including telephone and electricity shall be shut off or disconnected and removed in accordance with the supplying utilities' requirements and section 01510 and 01590 of this document.

3.04 EQUIPMENT AND MATERIALS DECONTAMINATION FACILITY

A. Upon completion of equipment and materials decontamination, the Owner's equipment and material decontamination facility shall be thoroughly washed down and sediments removed and disposed off-site by the Contractor. The area shall be returned to a condition comparable to preconstruction conditions and approved by the Owner/Owner's Representative.

END OF SECTION 01700

SECTION 01710
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions for maintaining Record Documents.

B. Requirements for Record Drawings: The Contractor shall provide both record drawings (redline markups of the Contract Drawings) and supplemental record drawings (newly created drawings).

1.02 RELATED SECTIONS

A. Section 01030 Contractor Safety and Health

B. Section 01700 Work Closeout

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. The Contractor shall maintain at the site for the Owner/Owner's Representative one record copy of:
   1. Construction Drawings
   2. Record and Supplemental Drawings (Continuously updated and accurate)
   3. Specifications
   4. Addenda
   5. Change Orders and other Modifications to the Contract
   6. Field Orders or written instructions
   7. Approved Working Drawings and Samples
   8. Field Test records
   9. Laboratory analyses
   10. Quality Assurance Reports and documentation
   11. Medical surveillance records
   12. Daily reports
   13. Meeting minutes
   14. Correspondence files
   15. Survey notes

B. The Contractor shall store documents and samples in Contractor's field office apart from documents used for construction.
   1. Provide files and racks for storage of documents.
   2. Provide locked cabinet or secure storage space for storage of samples.

C. The Contractor shall file documents and samples in accordance with CSI format.

D. The Contractor shall maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

E. The Contractor shall make documents and samples available at all times for inspection by the Owner/Owner's Representative.

F. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated "record documents" for review and comment by the Owner/Owner's Representative.

1.04 RECORDING

A. The Contractor shall label each document "PROJECT RECORD" in neat large printed letters.

B. The Contractor shall record information concurrently with construction progress. No work shall be concealed until required information is recorded.

1.05 SUBMITTALS

A. As part of Substantial Completion, Contractor shall deliver one (1) set of neatly marked Record Documents to the Owner/Owner's Representative.

B. The Contractor shall deliver all submittals required by the specifications to the Owner/Owner's Representative at completion of construction.

1.06 RECORD DRAWINGS

A. The Contractor shall clearly and neatly mark up in red ink one set of paper prints to show the record conditions. The record marked prints shall be kept current and available on the job-site at all times. All changes from the contract plans that are made in the work, or additional information that might be uncovered during the course of construction, shall be accurately and neatly recorded as they occur by means of details and notes. The record marked prints shall be jointly inspected for accuracy and completeness by the Owner/Owner's Representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. The drawings shall show the following information, but not be limited thereto:

1. The location and description of any utility lines, below-grade permanent structures or other installations of any kind or description known to exist within the construction area. The location includes dimensions to permanent features.
2. The location and dimensions of any changes within the design and any project components.

3. Correct grade or alignment of wells, structures, utilities, or project component if any changes were made from contract plans.
4. Changes in details of design or additional information obtained from working drawings specified.
5. All changes or modifications which result from the final inspection.
6. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record prints.

1.07 SUPPLEMENTAL RECORD DRAWINGS

A. The Contractor shall prepare and submit supplemental record drawings of the work completed as described in the technical specifications.

B. Record and Supplemental Record drawings shall be stamped and signed by a land surveyor licensed in the State of Ohio.

C. Each record drawing shall be prepared on a 24" by 36" sheet and shall locate all work included in the Contract.

D. All locations shall be referenced to a horizontal coordinate system. The grid coordinate system shall be shown on all record drawings. Elevations shall be referenced to the vertical control established for the project.

E. An electric file of each record drawing in AutoCad Release 14 or 2000 shall be provided to the Owner/Owner's Representative.

1.08 DRAWING PREPARATION

A. Two (2) copies of the final record (redline) drawings will be provided by the Contractor after final approval of the drawings by the Owner/Owner's Representative.

B. After final acceptance of the Supplemental Record Drawings, the Contractor shall provide one set of Mylars (stamped by a licensed surveyor), and six sets of blue prints.

PART 2 - PRODUCTS

2.01 Not used.

PART 3 - EXECUTION

3.01 Not used.

END OF SECTION 01710

Division 2
Site Work

SECTION 02130
CONTAMINATED MATERIALS HANDLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes specifications for the management of contaminated materials encountered during the implementation. It is the intent that all necessary precautions are taken to protect workers from exposure to contaminated materials, and that all contaminated materials excavated, pumped or otherwise removed from their point of origin are minimized to the extent practical and managed in accordance with applicable regulations and guidelines.

1.02 RELATED SECTIONS

A. Section 01030 - Contractor Health and Safety

B. Section 01120 - Decontamination of Personnel and Equipment

C. Section 01320 - Submittals

D. Section 01560 - Environmental Protection

E. Section 01700 - Work Closeout

F. Section 02675 - DNAPL Recovery Well Drilling

G. Section 02676 - DNAPL Recovery Well Installation

1.03 DESCRIPTION OF WORK

A. The work in this section consists of handling and disposal of materials designated for disposal. This includes the development water, decontamination water, and project-generated contaminated materials.

1.04 SUBMITTALS

A. The Contractor shall devise and submit a Contaminated Materials Handling Plan to minimize and manage runoff discharge during contaminated materials handling. This plan shall be submitted to the Owner/Owner's Engineer for review and approval a minimum of 30 days prior to start-up of the construction activities

B. At a minimum, this plan shall provide the equipment to be used, transport routes to the SOU Landfill if necessary, proposed methods for minimizing run-on waters and minimizing contaminated material exposures, and equipment decontamination procedures.

C. Licenses: Contractor will provide copies of transporter's licenses to transport special or hazardous or special waste in the State of Ohio.

PART 2 – PRODUCTS

2.01 Not Used

PART 3 – EXECUTION

3.01 CONTAMINATED SOIL DISPOSAL

A. All excavated contaminated materials designated for disposal will be transported by designated haul route to the SOU Landfill for disposal. Contractor shall place materials in the SOU Landfill at the direction of the of the SOU Contractor

B. Contractor is responsible for complying with all local, state, and federal regulations applicable to the transport of contaminated or special waste.

C. Contractor is responsible for obtaining all required permits or licenses, or sub-contracting a licensed transporter, to transport contaminated materials on public roadways.

D. Soils will be transported directly to the SOU Landfill and will not be co-mingled with wastes from any other off-site locations.

3.02 CONTAMINATED WATER RECOVERY AND HANDLING

A. All groundwater recovered during DNAPL recovery well development shall be considered contaminated. All surface water runoff into this area during work activities shall also be considered contaminated.

B. Contractor shall transfer all contaminated water via closed conduit to the Detrex water treatment system for treatment.

C. Contractor shall provide all necessary safety personnel and equipment, including protective gear, emergency equipment, monitoring equipment, and decontamination facilities required for handling the contaminated water in accordance with Contractor's approved Health and Safety Plan.

3.03 HEALTH AND SAFETY CONSIDERATIONS

A. Contractor shall perform all handling of excavated materials in strict accordance with the Contractor's approved Health and Safety Plan and Section 01030.

B. Contractor shall decontaminate all equipment that was used to handle contaminated soil before leaving the site in accordance with the Contractor's approved Health and Safety Plan.

C. Contractor shall provide all necessary safety personnel and equipment, including protective gear, emergency equipment, monitoring equipment, and decontamination facilities necessary to handle the contaminated materials in accordance with the Contractor's approved Health and Safety Plan.

END OF SECTION 02130

SECTION 02675
DNAPL RECOVERY WELL BOREHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes specification for the installation of the DNAPL recovery well boreholes. The Work shall include completion of recovery well bore-holes as shown on the project drawings.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements

B. Section 01030 – Contractor Health and Safety

C. Section 02130 – Contaminated Materials Handling

D. Section 02676 – DNAPL Recovery Wells

1.03 SUBMITTALS

A. Contractor shall submit in accordance with Section 1, General Requirements.

B. In addition, Contractor shall submit the following:
   1. Copies of drilling permits required by the State and local governing authorities.
   2. Proposed Schedule of Work and drilling methods and equipment.

1.04 QUALITY ASSURANCE

A. All on-site personnel shall be trained per 29 CFR 1910.120, including respiratory fit-testing.

B. Contractor shall have a minimum of 3 years of documented experience in the Work described in this Section.

C. Contractor shall complete borings and soil sampling under supervision of experienced driller capable of identifying geological formations.

D. Contractor shall attend conference at site prior to commencement of drilling. Owner/Owner's Representative will schedule this conference following Notice of Award.

PART 2 PRODUCTS

2.01 Not Used

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. The Contractor shall furnish all labor, materials, equipment, services and incidentals necessary to perform all recovery well drilling.

B. The Work shall include completion of recovery well bore-holes as shown on the project drawings, by use of a 3-inch outer diameter (OD) direct-push sampler, or other technique approved by the Owner/Owner's Representative.

C. Contractor shall establish boring locations as shown in Drawings. Contractor shall complete all borings in the approximate locations indicated on the drawings, with field verification provided by the Owner/Owner's Representative.

D. It shall be the Contractor's responsibility to investigate the actual conditions existing at the Site.

E. The Work shall be completed in such as manner as to prevent damage to existing structures and to provide safe working conditions.

F. All Work shall be completed in such a manner to minimize disturbance to the ground surface in areas where waste re-grading has occurred. Any damage to the ground surface in these areas shall be immediately repaired.

G. Where existing utilities are present, such as water mains, gas lines, electric conduits, etc., the Contractor shall uncover said pipes by hand digging as appropriate. The Contractor shall be responsible to advise all utilities and agencies of the extent, scope, and schedule of the operation.

3.02 SYSTEM DESCRIPTION

A. Performance Requirements

1. All borings shall be plumb and straight, with a minimum 3-inch outer diameter (OD). Contractor shall determine plumbness by lowering plumb bob into boring. Boring shall not be out of plumb by more than one boring diameter.
2. All borings shall extend, at a minimum, to the contact between the lacustrine sediments and the glacial till soils, as indicated on the project drawings. This depth is approximately 15 to 25 feet below ground

surface. The actual depth of specific borings shall be determined in the field based on conditions encountered at that location.

3.03 PROJECT CONDITIONS

A. Utilities and Reference Points

1. Necessary arrangements shall be made by the Contractor with all persons, firms, and corporations owning or using any poles, pipes, tracks or conduits, etc., affected by the boring completion included under these specifications. Contractor to maintain and protect such facilities during site activities. The Contractor shall pay the cost of any such protection.
2. Contractor shall verify location and existence of underground utilities and protect existing utilities from damage caused by construction activities. Damage to utilities shall be repaired at Contractor's expense. No cost to Owner/Owner's Representative shall be assessed for damages to utilities.
3. Contractor shall protect and maintain benchmarks, monuments, and other established reference points. If disturbed or destroyed, Contractor shall replace damaged reference points to satisfaction of Owner/Owner's Representative.
4. Contractor shall protect and maintain ground surface covering in areas where waste has been regraded. If disturbed or destroyed, Contract shall replace ground covering to satisfaction of Owner/Owner's Representative.

B. Site Investigation Report.

1. A Site Investigation Report has been prepared by the Owner/Owner's Representative and is available at the office of the Owner/Owner's Representative. This report may be used as a guide to the subsurface conditions on this project. The boring logs, chemical data, and related information depict subsurface conditions only at the specific locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from conditions depicted at a particular boring location. Also, the passage of time may result in changes to the subsurface conditions.

3.04 SCHEDULING AND SEQUENCING

A. Contractor shall coordinate start of Work with Owner/Owner's Representative. Drilling schedule shall be established with Owner/Owner's Representative at least 7 calendar days before initiating Work.

B. Contractor shall sequence installation of Phase I DNAPL recovery wells in locations identified on the Drawings drilling with other Project Work.

3.05 DRILLING AND SOIL SAMPLING

A. Drilling Equipment
   1. Contractor shall provide clean, well-maintained equipment in good operating condition. Equipment shall be operated and maintained in accordance with manufacturer's recommendations.
   2. Contractor shall provide a drilling rig capable of:
      a. Accessing borehole locations shown on Drawings.
      b. Advancing borings to depth and diameter shown on Drawings.
   3. Contractor shall provide all necessary equipment and materials for drilling, maintaining an open boring, and soil sampling.

B. Contractor shall minimize use of water during drilling to avoid dilution of groundwater and introduction of foreign substances into boring. No drilling muds or additives shall be introduced into boring without prior approval of the Owner/Owner's Representative. The boring shall be stabilized as necessary to prevent wall cave-in and blow-in.

C. Contractor shall prevent contamination of boring and soil samples during drilling. Gasoline, hydraulic fluid, grease, oil, or other substances shall not be permitted to enter boring. Contamination of decontaminated equipment shall be prevented while drilling and soil sampling.

D. Contractor shall collect soil samples using direct push sampling sleeves as approved by Owner/Owner's Representative. Samples shall be continuous.

E. Contractor shall decontaminate drilling rig and accessory equipment in accordance with the Contractors Contaminated Materials Management Plan, Health and Safety Plan, and Division 1, General Requirements. Decontamination will be performed upon bringing equipment on-site, before drilling the first recovery well borehole, between boreholes, and prior to leaving the site.

3.06 SITE RESTORATION

A. At completion of Work at each drilling location, Contractor shall remove all equipment, unused materials, temporary facilities, debris, and miscellaneous items resulting from or used during the operations. Site shall be restored to original conditions or better.

B. Contractor shall place all drill cuttings on minimum 10-mil thick plastic sheeting and cover all cuttings with similar sheeting. As directed by the Owner/Owner's Representative, all cuttings shall be loaded and transported by the Contractor to the SOU Landfill located on the adjoining RMI Titanium property.

C. In the event that drill cuttings are not acceptable for disposal at the SOU Landfill, Contractor shall place cuttings in sealed, DOT 17H, open-head, 55-gallon drums. Each drum shall be permanently labeled with contents, date, and boring identification. Contractor will transport drums to a designated storage area on Detrex Corporation property. Detrex Corporation will accept responsibility for further characterization and disposal of drums.

3.07 FIELD QUALITY CONTROL

A. Contractor shall provide a boring log to the Owner/Owner's Representative for each location with the following information:
   1. Reference point for depth measurements,
   2. Description of geologic materials per the Unified Soils Classification Method (USCM) and depth where encountered,
   3. Depth of water entry during drilling,
   4. Static water level,
   5. Depths of lost circulation and methods employed to regain circulation,
   6. Drilling termination depth,
   7. Time, depth, and description of problems and corrective measures, and
   8. Depth and diameter of temporary casing.

B. Contractor shall use the attached boring log or a substitute boring log sheet that has been approved by the Owner/Owner's Representative.

END OF SECTION 02675

SECTION 02676
DNAPL RECOVERY WELLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes information for the installation of the Phase I DNAPL recovery wells.

1.02 RELATED SECTIONS

A. Section 1, General Requirements

B. Section 02130 – Contaminated Materials Handling

C. Section 02675 – DNAPL Recovery Well Drilling

1.03 SUBMITTALS

A. Contractor shall submit in accordance with Section 1, General Requirements.

B. In addition, Contractor shall submit the following:
   1. Proposed schedule of Work and methods for recovery well construction,
   2. Shop drawings, manufacturers' data, and certifications for well casing pipe, well screen, joints, and fittings and all other materials used for the successful completion of the DNAPL recovery wells.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A53 - Specification for Pipe, Steel, Black, and Hot Dip Galvanized Zinc-Coated, Welded and Seamless
   2. A312 - Specification for Seamless and Welded Stainless Steel Pipe
   3. C94 - Specification for Ready-Mixed Concrete
   4. C150 - Specification for Portland Cement

1.05 DESCRIPTION OF WORK

A. Contractor shall furnish all labor, materials, tools, equipment, services, and incidentals required to install Phase I recovery wells. Recovery wells will be used for extraction of a dense, non-aqueous phase liquid (DNAPL) in the subsurface.

B. Contractor shall furnish all labor, materials, tools, equipment, services, and incidentals required for developing DNAPL recovery wells.

C. Contractor shall install and develop all DNAPL recovery wells as indicated on the drawings, specified herein, or specified by the Owner/Owner's Representative. The work shall include installation of twelve (12) DNAPL recovery wells at the location specified in the attached specification drawings.

D. All work shall be completed in such a manner to prevent damage to existing structures and to provide safe working conditions.

E. All work shall be completed in such a manner to minimize disturbance to the ground surface in areas where waste re-grading has occurred. Any damage to the ground surface in these areas shall be immediately repaired.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Contractor shall have a minimum of 3 years of documented experience in the Work described in this Section.
   2. On-site personnel shall be trained per 29 CFR Part 1910.120.
   3. Contractor shall attend a pre-construction conference at site prior to commencement of well installation. Owner/Owner's Representative will schedule this conference following Notice of Award.

1.07 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
   1. Contractor shall furnish well casing and screen.
   2. Contractor shall furnish granular and powdered bentonite and Portland cement in bags free of rips or tears.
   3. Contractor shall inspect products and materials delivered to site. Products and materials that are damaged, show evidence of being previously used, or are unsatisfactory in other ways shall be rejected.
   4. Contractor shall store products and materials in area designated by Owner/Owner's Representative. Products and materials shall be protected from physical damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Well Casing Pipe, Screen, and Fittings

1. Well casing shall be 1.5-inch diameter, Schedule 5 flush-threaded carbon steel pipe, or approved equal.
2. Pipe joints shall provide a leak-proof seal. Any gasket materials must be compatible with the DNAPL constituents.
3. Well screen shall be 10-foot long section of 1.5-inch diameter, slotted (0.020-inch), factory milled, Type 304 stainless steel, or approved equal.
4. Bottom plug shall be flush-threaded, stainless steel.
5. Pipe, screen, and fittings shall be free of ink marks, oil, grease, and dirt.
6. Acceptable manufacturers:
   a. Johnson
   b. Or approved equivalent submitted in writing and approved by the Owner/Owner's Representative.

B. Filter Pack and Buffer Sand

1. Contractor shall utilize thoroughly washed and kiln dried, sound, durable, well-rounded siliceous sand, containing when placed less than 5 percent silt and clay and no organic material, anhydrite, gypsum, mica, or calcareous material. Specific gravity of the buffer sand shall be greater than 2.5.
2. Contractor shall utilize filter pack consisting of poorly-graded, fine sand, classified SP using the Unified Soil Classification System, with the following gradation:

Sieve Size	Percent Passing
#20	99
#40	50
#100	6

3. Owner/Owner's Representative may require a different filter pack gradation based on geologic conditions encountered at the time of installation.
4. Acceptable manufacturers:
   a. Colorado Silica Sand, Inc.
   b. Ottawa Sand
   c. Lone Star
   d. Or approved equivalent submitted in writing and approved by the Owner/Owner's Representative.

C. Bentonite Pellets

1. Bentonite pellets shall be sodium bentonite.

2. Acceptable manufacturers are
   a. Wyo-Ben, Inc.,
   b. American Colloid Company, Inc.
   c. Or approved equivalent submitted in writing and approved by the Owner/Owner's Representative.

D. Portland Cement shall be Type I or Type II, as specified in ASTM C150.

2.02 MIXES

A. Water for mixing shall be ASHCO process water supply serving the Detrex facility.

B. Concrete shall be Sacrete U-mix, or approved equal, mixed according to manufacturer's specifications.

PART 3 EXECUTION

3.01 SYSTEM DESCRIPTION

A. Prior to installation of Recovery Wells, Contractor shall measure groundwater and DNAPL levels in boring. Owner/Owner's Representative shall approve all screened intervals and riser length prior to installation of the DNAPL recovery well.

3.02 SCHEDULING AND SEQUENCING

A. Contractor shall coordinate start of Work with Owner/Owner's Representative. The recovery well installation schedule shall be established with Owner/Owner's Representative at least 7 calendar days before initiating Work.

B. Contractor shall sequence completion of Phase I DNAPL recovery well borings in the locations identified on the Drawings with the drilling of the DNAPL recovery well boreholes, other Project Work, and the ongoing activities performed at the facility. The sequencing shall be subject to approval by the Owner/Owner's Representative

3.03 UTILITIES AND REFERENCE POINTS

A. Verify location and existence of underground utilities. Protect existing utilities from damage caused by construction activities. Repair damage to utilities at own expense. Assess no cost to Owner for damages to utilities.

B. Protect and maintain benchmarks, monuments, and other established reference points. If disturbed or destroyed, replace to satisfaction of Owner/Owner's Representative.

C. Protect and maintain ground surface covering in areas where waste has been re-graded. If surface covering is disturbed or destroyed, replace to satisfaction of Owner/Owner's Representative.

3.04 EXAMINATION

A. Contractor shall examine recovery well bore-hole and remove blow-in or cave-in materials. Obstructions shall be corrected before installing well screen and casing. Owner/Owner's Representative will make the final determination that the borehole is acceptable for conversion to a recovery well.

B. Contractor shall inspect well materials for conformance to these Specifications. Non-conforming materials shall be rejected or corrected.

3.05 INSTALLATION

A. Contractor shall install recovery wells as shown on Drawings. Actual installed position of well screen will depend on geologic conditions encountered in the field. Owner/Owner's Representative will decide actual depth to bottom of well.

B. When installing well casing and screen, Contractor shall:
   1. Assemble bottom plug, screen well casing, and centralizers above ground. Contractor shall ensure all couplings are hand-tightened,
   2. Prevent contact of well assembly with grease, oil, dirt, or other potential contaminants,
   3. Insert well assembly into boring and position at target depth,
   4. Temporarily cap well casing that extends aboveground, and
   5. Suspend well assembly in boring until filter pack is placed.

C. When installing filter pack and buffer sand, Contractor shall:
   1. Compute required volumes of filter pack and buffer sand,
   2. Introduce filter pack and buffer sand to annular space in a manner that allows even placement around the well screen utilizing a tremie pipe or other approved method,
   3. Where placing filter pack and buffer sand inside temporary casing, incrementally pull temporary casing during placement without pulling the temporary casing above top of placed filter pack or buffer sand, and
   4. Periodically sound depth to filter pack and buffer sand to ensure continuous placement around well screen without separation or bridging.

D. When installing the bentonite seal, Contractor shall:
   1. Compute required volume of bentonite pellets,

2. Introduce bentonite pellets to annular space in a manner that allows even placement around well casing utilizing a tremie pipe or other approved method,
3. Where placing bentonite seal inside temporary casing, pull temporary casing during placement without pulling temporary casing above top of placed bentonite seal,
4. Periodically sound depth to bentonite seal to ensure continuous placement around well casing without separation or bridging,
5. Where placing bentonite seal above water table, add 1 gallon of ASHCO water for every 6 inches of placed seal.

E. For well completion, Contractor shall:
1. Terminate the above-grade portion of the casing with a 1.5" NPT connection a minimum of 1 foot above ground surface; and,
2. Install a 1.5" NPT to barbed fitting, male or female, as appropriate. Fitting shall be of high-density polyethylene (HDPE) or polypropylene construction.

F. Development
1. Contractor shall furnish pumps, compressors, plungers, surge blocks, bailers, and other equipment to develop recovery wells.
2. Development shall begin no sooner than 48 hours after installation of bentonite seal, and no later than 5 days.
3. Contractor shall develop recovery wells until well water is free from sand, silt, and clay, or as approved by Owner/Owner's Representative.
4. A minimum volume of liquid equal to 5 times the well and filter pack volume plus quantity of water introduced to boring and well during drilling shall be removed for the wells to be developed.
5. Contractor shall not introduce air, water, or other additives to recovery wells during development.
6. Development water shall be temporarily contained in 55-gallon drums provided by Contractor or in secondarily contained tank located in a central area designated by the Owner/Owner's Representative. If 55-gallon drums are to be used, these drums will subsequently be pumped into the central holding tank. Once liquid in the tank has stabilized, the water shall be decanted and transferred to the Detrex wastewater treatment system. If directed by Owner/Owner's Representative, Contractor shall characterize and dispose of DNAPL fraction in accordance with all Federal, State, and Local regulations.

G. Location Survey
1. Contractor shall provide a well location survey completed by a surveyor licensed in State of Ohio.
2. Survey results shall be State Planar.

3. Contractor shall provide Owner/Owner's Representative with tabulated results in an electronic format compatible with AutoCAD Release 14 or 2000.

3.06 SITE RESTORATION

A. At completion of Work at each well location, Contractor shall remove all equipment, unused materials, temporary facilities, debris, and miscellaneous items resulting from or used in the operations. Restore site as nearly as possible to original conditions.

3.07 FIELD QUALITY CONTROL

A. Contractor shall prepare a well construction log with the following information:
   1. Reference point for depth measurements,
   2. Boring diameter,
   3. Depth to bottom of well,
   4. Type, manufacturer, and dimensions of well casing, screen, and fittings,
   5. Screened interval,
   6. Filter pack and buffer sand interval and quantity used,
   7. Bentonite seal interval and quantity used,
   8. Cement grout interval and quantity used,
   9. Well completion details, and
   10. Problems and corrective measures.

B. Contractor shall provide a record well development log with the following information:
   1. Quantity of liquid removed.
   2. Appearance of liquid and approximate percentages of DNAPL and water.
   3. Problems and corrective measures.

C. Contractor shall use attached well construction and well development logs, or approved substitute.

D. Contractor shall provide a well location survey completed by approved land surveyor registered in the State of Ohio. The survey shall provide top of recovery well casing and ground surface at each recovery well with a tolerance of plus or minus 0.01 feet vertical, plus or minus 0.1 feet horizontal. Coordinate system shall be State Planar.

3.08 DEMONSTRATION

A. Contractor shall demonstrate that recovery well conforms to these Specifications, including but not limited to:

1. Screen and casing in correct position.
2. Well casing and screen plumb and straight.

B. Contractor shall abandon and install substitute recovery wells not conforming to these Specifications at no additional cost to Owner. Owner/Owner's Representative will select the location of replacement wells.

END OF SECTION 02676

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes specification information for the use of concrete on this project.

B. In general the Contractor shall be required to furnish all equipment and material, and perform all labor manufacture, transport, place, finish, and cure concrete, and place forms and reinforcing in the structures and as shown on the drawings and as specified herein.

1.02 RELATED SECTIONS

A. Section 02676 - DNAPL Recovery Wells

B. Contract Drawings – Building Pad

1.03 SUBMITTALS

A. Certified concrete mix design analysis

1.04 DESCRIPTION OF WORK

A. Concrete used shall be such as is applicable for building pads and footers, , extraction wells, and sanitary clean-outs. Reinforcement shall be welded steel wire unless otherwise noted in the drawings.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement:
   1. Cement shall be Portland Cement Type II as specified in ASTM C150.

B. Aggregates:
   1. Coarse aggregate: The grading of the coarse aggregate shall conform to Size 56 as given in ASTM C33. Aggregates as delivered to the mixer shall consist of clean, hard and un-coated particles. Maximum wear 50% and 500 revolutions, AASHTO T96.

2. Fine Aggregates: Aggregates shall conform to ASTM C33. For fine aggregate, the optimal grading is given in ASTM C33, Section 5.2, and the restriction on reactive materials is given in ASTM C33, Section 6.3.

C. Admixtures

1. General: The concrete shall contain an air-entraining admixture, and, at the option of the Contractor, may contain a water-reducing admixture. Calcium chloride and other accelerating admixtures and retarding admixtures shall not be used.
2. Air-entraining Admixtures: The air-entraining admixture shall conform to ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions.
3. Water-reducing Admixture: The water-reducing admixture shall conform to ASTM C494, Type A or ASTM C494 Type D.

D. Curing Materials

1. Impervious Sheet Materials: Impervious sheet materials shall conform to ASTM C171, type optional except polyethylene film which, if used, shall be white opaque.
2. Membrane-Forming Curing Compound: Membrane-forming curing compound shall conform to ASTM C309, Type 1-D or Type 2, as approved or specified herein.

E. Water for mixing shall conform to ASTM C94, Section 4.1.3.

2.02 CONCRETE MIX DESIGN

A. All concrete shall have a minimum 28-day compressive strength of 4,000 psi, a maximum water-cement ratio by weight of 0.45 and a minimum cement content of 550 pounds per cubic yard. Concrete used for construction of the treatment system building pad shall conform to ODOT Specification 451. The finished surfaces shall have a smooth finish.

B. 2 test cylinders will be collected for the concrete used and analyzed for compressive strength in accordance with ODOT Specification 511.

C. All concrete shall contain a water-reducing admixture.

D. All concrete exposed to the weather or water, or subject to freezing shall be air-entrained.

E. Slump: Concrete without high range water reducing admixture - 3 inches maximum.

SECTION 13121
PRE-ENGINEERED EQUIPMENT STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of the pre-engineered equipment building that houses the vacuum blower, air compressor and DNAPL/water separator.

B. Installation of two (2) satellite pumphouse enclosures for containment of the air diaphragm DNAPL recovery pumps, pump manifolds, and the vacuum splitter boxes for separation of the soil vapor extraction lines from the DNAPL recovery lines.

1.02 RELATED SECTIONS

A. Section 1, General Requirements

B. Section 02130 – Contaminated Materials Handling

C. Section 03300 – Cast-In-Place Concrete

D. Section 16010 – Basic Electrical Requirements

E. Section 16050 – Basic Electrical Materials and Methods

1.03 SUBMITTALS

A. Contractor shall submit the following:
   1. Proposed schedule of Work and methods for equipment building and pump enclosure construction.
   2. Shop drawings and manufacturers' data for the equipment building.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. C150 - Specification for Portland Cement

1.05 DESCRIPTION OF WORK

A. Pre-Engineered Equipment Building
   1. Contractor shall furnish all labor, materials, tools, equipment, services, and incidentals required to construct an equipment building with a nominal footprint of 16.0' in width by 20.0' in length. The sidewall height

shall be a minimum of 7.0' and the building roof shall be sloped to drain precipitation and snowmelt.

2. The building shall be bolted to the concrete pad constructed under Section 03300.
3. The building shall be equipped with insulation, lighting, electrical outlets and heating as shown on the Contract Drawings.

B. Satellite Pumphouse Enclosures
1. Contractor shall furnish all labor, materials, tools, equipment, services, and incidentals required to construct the satellite pump house enclosures.
2. The enclosures shall be set on level, plywood bases that are anchored to steel framing (Unistrut) posts set in concrete below the design freeze depth of 42".

C. General
1. All work shall be completed in such a manner to prevent damage to existing structures and to provide safe working conditions.
2. All excavation work shall be conducted in a manner that minimizes the actual amount of material removed. All excavation spoils shall be handled per Section 02130 – Contaminated Materials Handling.
3. All work shall be completed in such a manner to minimize disturbance to the ground surface in areas where regrading has occurred. Any damage to the ground surface in these areas shall be immediately repaired.

1.06 QUALITY ASSURANCE

A. Qualifications
1. Contractor shall have a minimum of 3 years of documented experience in the Work described in this Section.
2. On-site personnel shall be trained per 29 CFR Part 1910.120.

1.07 DELIVERY, STORAGE AND HANDLING

A. Contractor shall inspect products and materials delivered to site. Products and materials that are damaged, show evidence of being previously used, or are unsatisfactory in other ways shall be rejected.

B. Contractor shall store products and materials in area designated by Owner/Owner's Representative. Products and materials shall be protected from physical damage.

PART 2 PRODUCTS

2.01 Pre-Engineered Equipment Building
A. The equipment building shall be:

1. Heartland Industries 16x24x15 Deluxe Estate Yard Barn with a 7' Sidewall
2. Or approved equivalent submitted in writing and approved by the Owner/Owner's Representative.

B. Heating and Ventilating
   1. The interior of the building walls and roof shall be covered with insulation between the framing members.
   2. The building shall be equipped with an electric heater that, in combination with the insulation specified above, is capable of maintaining the interior of the building at 40°F at times when exterior temperatures are at -20°F for an extended period.
   3. The heater shall operate on 120V or 460V power and shall be manufactured by Q.Mark or approved equal.
   4. The building shall be equipped with a manual exhaust fan with shutters.
      a. The fan shall be chemically resistant and have a minimum 16-inch propeller diameter capable of changing out the building volume in 2 minutes.
      b. The fan shall by Dayton Stock No. 5C531 as supplied by Grainger Supply Co. or approved equal.

C. Lighting
   1. Overhead, temperature resistant, industrial light fixtures shall be installed as shown on the Contract Drawings.
   2. The lighting shall operate on 120V power.
   3. Overhead lights shall be Cooper Lighting Metalux Type F96T12HO as supplied by Grainger Industrial Supply or approved equal.

2.02 Satellite Pumphouse Enclosures

The satellite pumphouse enclosures shall be:

A. Eagle Two-Drum Secondary Containment Workstations, Model No. OA-7405, as supplied by Lab Safety Supply,

B. Or approved equivalent submitted in writing and approved by the Owner/Owner's Representative.

PART 3 EXECUTION

3.01 SCHEDULING AND SEQUENCING

A. Contractor shall coordinate start of Work with Owner/Owner's Representative at least 7 calendar days before initiating Work.

B. Contractor shall sequence completion of the equipment building with the completion of the building pad, allowing a minimum of 7 calendar days for the concrete building pad and footer to cure. The sequencing shall be subject to approval by the Owner/Owner's Representative.

3.02 UTILITIES AND REFERENCE POINTS

A. Contractor shall verify location and existence of underground utilities. Protect existing utilities from damage caused by construction activities. Repair damage to utilities at own expense. Assess no cost to Owner for damages to utilities.

B. Contractor shall protect and maintain benchmarks, monuments, and other established reference points. If disturbed or destroyed, replace to satisfaction of Owner/Owner's Representative.

C. Contractor shall protect and maintain ground surface covering in areas where regrading has occurred. If surface covering is disturbed or destroyed, replace to satisfaction of Owner/Owner's Representative.

3.03 EXAMINATION

A. Contractor shall inspect building materials for conformance to these Specifications.
B. Non-conforming materials shall be rejected or corrected.

3.04 INSTALLATION

A. Pre-Engineered Equipment Building
   1. Contractor shall install the equipment building on the concrete slab as shown on the Contract Drawings.
   2. Wall framing shall be bolted to the building pad curb every 4 linear feet at a minimum.
   3. Insulation shall be installed between the framing members along the interior walls and roofline.

B. Satellite Pumphouse Enclosures
   1. Contractor shall field-verify proposed pumphouse enclosure locations and orientations and receive the approval of Owner's representative prior to installation.
   2. Contractor shall install the enclosures on a level surface above existing grade that is protected from damage from frost heaving. Contractor shall install the surface as shown on the Contract Drawings or by an alternative design that is approved by Owner's Representative.
   3. Contractor shall install the steel framing members in a drilled borehole, set the members vertically in concrete, and allow the concrete to set a minimum of

24 hours prior to installation of the horizontal framing members and the level, plywood flooring material.

3.05 SITE RESTORATION

At completion of Work, Contractor shall remove all equipment, unused materials, temporary facilities, debris, and miscellaneous items resulting from or used in the operations. Restore site as nearly as possible to original conditions.

END OF SECTION 13121

SECTION 15000
MECHANICAL EQUIPMENT, CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Equipment, controls and instrumentation to be located in the Equipment Building.

B. Equipment, controls and instrumentation to be located in the two Satellite Pumphouse Enclosures.

1.02 RELATED SECTIONS

A. Section 13121 – Pre-Engineered Equipment Structures

B. Section 15050 - Pipe, Tubing And Valves

1.03 SUBMITTALS:

The Contractor's submittals shall include but not be limited to, the following:

A. Proposed schedule of work and methods for installation of equipment, controls and instrumentation.

B. Equipment and instrumentation list, including size, dimension, design capacity, expected range of operations, utility requirements, and materials of construction for all of the principle components in the Equipment Building and the Satellite Pumphouse Enclosures.

C. Manufacturer's technical literature, performance charts and curves;

D. The following Engineering drawings and calculations for review and approval by the Owner/Owner's Representative. All drawings and calculations shall be prepared by a licensed Professional Engineer (electrical) registered in Ohio as follows:

1. Complete internal main control panel equipment layout drawing.
2. Complete external main control panel equipment layout drawing
3. Complete electrical wiring schematic depicting all of the following:
   a. 460 VAC, 3 phase equipment
   b. 120 VAC single phase equipment
   c. 24 VDC equipment
   d. PLC cabling and communications
   e. PLC Ladder Logic and Control Logic diagrams in both IEEE and approved ISA/JIC conventional language format as well as PLC machine language format shall be submitted for review.

f. Perform electrical load study to determine effective sizing of the total electrical system and sizing of the isolation transformer, wiring and bonding/grounding requirements while also determining their effective size.

g. Sizing of, cooling system and electrical wiring schematics for main control panel.

4. All other wiring schematics, communication, calculations, logic diagrams as required for a complete functioning system.

E. Operating and maintenance instructions for each different type of equipment, instrument, and/or control system.

F. Engineering description of sequence of operations and control methodology.

G. List of recommended spare parts.

H. Performance start-up procedures and evaluation criteria.

I. Operating and maintenance records from system start-up.

1.04 DESCRIPTION OF WORK:

A. The Contractor shall furnish, install and test equipment, controls and instrumentation required to collect and treat groundwater and dense non-aqueous phase liquid (DNAPL) from the Detrex Corp., Ashtabula, Ohio site.

B. The scope of services shall include but not be limited to:

1. All labor, materials, and services associated with fabrication, construction, installation, startup and testing of the system.
2. Rectification of all construction and operating problems that prevent the system from achieving the required performance.

1.05 CONSTRUCTION DOCUMENTS

A. Construction Documents for the system establish performance and quality requirements.

B. Work shown or described herein is not intended to be a complete representation of actual finished work. The work shall include all equipment and materials required for a complete and operating system, although some items are not specified or shown. Any work that is necessary or required to make the installation satisfactory and operable for its intended purpose, even though not specifically included, shall be performed as incidental work as if it were described in these specifications.

1.06 APPLICABLE STANDARDS:

All work shall be performed in accordance with current laws, regulations, ordinances and codes relating to construction including: National Electric Code (NEC), Occupational Safety and Health Administration (OSHA), Underwriters Laboratory (UL), American National Standards Institute (ANSI), Hydraulic Institute, and all other applicable Federal, State, and local codes.

1.07 GENERAL TESTING AND RESPONSIBILITY:

A. The Contractor shall be responsible for procurement and installation of compatible components, and shall perform all modifications necessary for the proper operation and guarantee of the equipment. The Contractor, if required by the Owner/Owner's Representative or as otherwise required by the Specifications, shall make such tests during the installation and upon the completion thereof, as may be necessary to demonstrate that the work and equipment, as installed, comply with the Contract Specifications and requirements of the Owner/Owner's Representative as provided herein. The Contractor shall provide all labor, instruments and apparatus required for such tests. If any of the work or equipment fails to meet the Contract requirements or to function properly, the defects shall be rectified by readjusting or by removing and replacing the faulty work or equipment, until under test the requirements are met, all at the Contractor's expense. The Owner/Owner's Representative reserves the right to check the Contractor's instruments or to furnish its own instruments.

B. The Contractor shall notify the Owner/Owner's Representative at least 10 days prior to scheduled shop testing of all the equipment.

1.08 ALTERATIONS TO ACCOMMODATE EQUIPMENT:

The Contract Drawings indicate a typical installation based on a certain make or brand of equipment and are not to be construed as representing the layout for any other make or brand. Any alterations that are necessary to adequately and satisfactorily accommodate the equipment to be installed under this Contract shall be made by the Contractor at his own expense, in accordance with the Contract Specifications, and subject to the approval of the Owner/Owner's Representative.

1.09 GENERAL REQUIREMENTS:

A. Standard Products: Material and equipment that are provided as components of the system shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use under similar duty for at least 5 years. Equipment shall be supported by a service organization that is convenient to the site. The Owner/

Owner's Representative will solely determine acceptability of such service organization.

B. Nameplates: Major equipment items shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

C. Verification of Dimensions: The Contractor shall become familiar with all details of work, verify all dimensions in the field, and shall advise the Owner/Owner's Representative of any discrepancy before performing the work.

1.10 MANUFACTURER'S SERVICES

Services of a qualified, factory trained, service representative(s) who is experienced in the installation, startup, adjustment, and operation of the equipment, instrumentation, and controls specified shall be provided. The service representative shall supervise the installation, startup, adjustment, and testing of the equipment and instruct the Owner's operating personnel in the proper care and operation of the equipment, instrumentation, and controls.

PART 2 - PRODUCTS

At a minimum, treatment system equipment and instrumentation shall include:

2.02 VACUUM BLOWER

One (1) Vacuum Blower (B-102).

Manufacturer	EG&G Rotron
Model No.	EN606M72L
Part No.	038179
Material	Cast Aluminum Housing
Capacity	200 SCFM @ 0" Hg
Dimensions	17.7" L x 14.8"W x 15.8"H
Power	3.0 HP/460V/3Ø/60 Hz
Maximum Suction	30 SCFM @ 5.5" Hg
Inlet	2" FNPT
Outlet	2" FNPT

As supplied by EG&G Rotron of Saugerties, New York, or approved equal. The vacuum blower system shall include appropriate silencers and a moisture separator with low, high, and high-high level controls.

2.03 DNAPL/WATER SEPARATOR

One (1) (DNAPL)/Water Separator (T-101).

Manufacturer	Hydro Quip, Inc.
Model	HQI AGM-2SS-60V-HP Separator with cover
Material	304 Stainless Steel
Capacity	238 gallon liquid capacity
Dimensions	28" W x 48" H x 64" L
Inlet	2" FNPT
Outlet	2" FNPT
Modification	Hopper built as reverse pyramid for DNAPL recovery

As supplied by Tanx Distribution, Inc. of N. Attleboro, MA, or approved equal.

2.04 AIR DIAPHRAGM PUMPS (2)

Two (2) Air Diaphragm Pumps (P-101, P-102)

Manufacturer	ARO
Model	66605K-444
Type	1/2" Non-Metallic Air-Operated Diaphragm Pump, Kynar (PVDF) or Polypropylene Construction
Pump Capacity	3 gpm @ 210' TDH, 100 psi
Air line connection kit	66073-2
Filter/Regulator:	ARO Model No. P29122-600 or approved equal.

As supplied by HLT, Inc. of Cleveland, Ohio, or approved equal.

2.05 DNAPL STORAGE TANK

One (1) DNAPL storage tank with secondary containment (T-102)

Manufacturer	Highland Tank
Model	Dike Tank
Material	Stainless Steel
Capacity	1,500-Gallon Tank with 110% Secondary Containment
Tank Dimensions	5'4" D x 9'0" L
Dike Dimensions	13'10" L x 8'0" W x 2'0" H

As supplied by Highland Tank & Mfg. Co., or approved equal.

2.06 NAPL TRANSFER PUMP

One (1) Air Diaphragm Pump (P-107)

Manufacturer	ARO
Model	66605K-444
Type	1/2" Non-Metallic Air-Operated Diaphragm Pump, Kynar (PVDF) or Polypropylene Construction
Pump Capacity	3 gpm @ 210' TDH, 100 psi
Air line connection kit	66073-2
Filter/Regulator	ARO Model No. P29122-600 or approved equal.

As supplied by HLT, Inc. of Cleveland, Ohio, or approved equal.

2.07 AIR COMPRESSOR

Manufacturer	Ingersoll-Rand
Model	Model 7100E15
Type	Reciprocating, 120 gallon horizontal tank
Power	460V/3 pH/60Hz
Horsepower	15 HP
Dimensions	45-1/2" D, 64" H
Inlet/Outlet	4"/4"
Capacity	50 SCFM at 100 psi
Material	Epoxy Lined Steel

As supplied by Air Power of Ohio or approved equal.

2.08 VAPOR-PHASE GRANULAR ACTIVATED CARBON FOR SVE SYSTEM:

Two (2) vapor phase granular activated carbon canisters (T-104, T-105)

Model	VX-1000
Dimensions	45-1/2" D, 70" H
Inlet/Outlet	6"/6"
Capacity	1,000 Lbs.
Canister Material	Stainless Steel
Filter Media	Type 208C, 4 x 8 mesh

As manufactured by WATERLINK Barnebey Sutcliffe or approved equal.

2.09 VAPOR PHASE GAC SEPARATOR/HOLDING TANK VENT CANISTER

One (1) vapor phase granular activated carbon canister (T-106)

Model	PX-200-V
Dimensions	23-1/2" D, 42" H
Inlet/Outlet	4"/4"
Capacity	180 Lbs.
Canister Material	Polyethylene
Filter Media	Type 208C, 4 x 8 mesh

As manufactured by WATERLINK Barnebey Sutcliffe or approved equal.

2.10 INSTRUMENTATION:

A. Electric Activated Values: To be determined
   1. Manufacturer and Model:
   2. Type: Ball
   3. Material of Construction: TFE and TFE lined steel

B. Vacuum Gauges:
   1. Manufacturer and Model: Dwyer
   2. Vacuum range: 0-6" Hg (Vacuum Blower)
   3. Type: Diaphragm protected.

C. Liquid Level Transmitter
   1. Manufacturer and Model: Viatran Corporation Model No. 516 or approved equal.
   2. Full Scale Pressure Range:
      LT1: To be determined
      LT2: To be determined
   3. Materials of Construction:
      a. Housing - 304 stainless steel
      b. Pressure Connection - 316 stainless steel
      c. Sensor - 304 stainless steel
      d. Cable/Cable Seal - TFE
   4. Mounting: Suspended by cable:
   5. Electrical:
      a. Output - 4-20 in mA
      b. Provide DC power supply
   6. Performance:
      a. Repeatability: $\leq \pm$ 0.05% Full Scale Output
      b. Temperature Effect: $\leq \pm$ 1.0% per 100EF Standard
      c. Operating Temperature: -40EF to 250EF

D. Level Indicators
   1. Manufacturer and Model: Martel Loop Panel Meter LPM-420 by Davis Instruments or approved equal.
   2. Input: 4-20mA
   3. Readout: 3.5 digit LCD by 0.5" high. Display in feet of water.
   4. Accuracy: ± 0.005% Full Scale Range
   5. Stability: 0.02% per EC
   6. Operating Temperature Range: -30EC to 65EC

E. Flow Sensor/Transmitters
   1. Manufacturer: VersaFLO
      Type: Doppler Flow Meter
   2. Transmitter:
      a. Sealed NEMA 4X electronics
      b. Isolated 4 to 20 mA output
      c. Flow rate and totalizer display
      d. Push button calibration
      e. User selectable range and units

F. Pressure Gauges
   1. Manufacturer and Model: To Be Determined
   2. Pressure range: 0-100 psi
   3. Type: TFE Diaphragm protected.

G. Level Switches
   1. Manufacturer and Model: Goulds Model A2-7 or approved equal.
   2. Materials of Construction: TFE coated housing with epoxy-sealed switch and cord conductors.

2.11 PROGRAMMABLE LOGIC CONTROLLER (PLC):

A. General:
The control system shall be a PLC-based system capable of monitoring, trending, and controlling the system.

B. The programmable logic controller (PLC) shall be an Allen Bradley modular SLC-500 5/03 CPU, or approved equal.

C. The PLC shall have input status indicators (LEDs) that will light when an input circuit is energized. It shall have an auto/manual switch. The PLC shall have a memory module (e.g. EEPROM) for backup and storage of programs and data. The PLC shall have an RS-232 communication port to allow it to communicate to a remote or local IBM or IBM-compatible computer, if desired by Owner.

1. Input: The PLC shall be capable of receiving and interpreting electrical signals from all the system instrumentation. Electrical/Electronic signals shall be of the following type:
   a. Alternating current: -20 to +20 MA.
   b. Direct current: -10 to +10 VDC.
   c. The PLC shall be capable of receiving both analog and discrete inputs.

   Required inputs shall be as presented on Contract Drawings.
2. Output: The PLC shall be capable of outputting signals to the system instrumentation. Output shall be either alternating or direct current, as required by the instrument receiving the signal. Voltage ranges shall be as follows:
   a. Alternating current: 85 to 265 VAC.
   b. Direct current: 10 to 50 VDC.

   Required control functions shall be as shown on the Contract Drawings
3. Alarming: The PLC shall be capable of determining if alarm set points are exceeded by performing comparative functions on the alarm set point and the real-time value. Alarms shall also be set when equipment (e.g. pumps) does not respond to a signal.
   Alarm conditions shall be as shown on the Contract Drawings.
   Required outputs shall be as shown on Contract Drawings.
4. Proportional, integral, derivative (PID) Control:
   The PLC shall be capable of performing system decision-making and control, if desired by Owner. The PLC shall be capable of performing several PID control loops.

2.12 MAIN CONTROL PANEL

A. The main control panel shall provide instrumentation, and wiring to control all basic cycles of operation and provide for automatic operation of the system.

B. The Main Control Panel - shall be as designated on the applicable Contract Drawings and will include the following features:
   1. Two (2) door, NEMA 12, free standing steel metal enclosure with key locking door handles. Minimum size of panel shall be 72" high x 36" wide x 12" deep.
   2. All control circuits and functions required for the system as depicted on the Contract Drawings and as specified herein.

C. The exterior of the main control panel shall have the required electrical connecting receptacles (120 VAC, single phase and an RS-232 connector) mounted through the control panel face mechanically fastened and sealed.

2.13 PORTABLE SAFETY SHOWER WITH EYE/FACE WASH

A. Manufacturer: Lab Safety Supply or approved equal.

B. Materials of Construction: Heavy wall, 2-inch diameter schedule 80 PVC pipe with 2-inch socket weld supply joint. 52-inch diameter floor flange ABS plastic showerhead. 10-inch diameter wash bowl with pop off covers. Stainless steel pull rod with triangular handle.

C. Valve Assembly: Chrome-plated brass, stay-open ball valves. Shower 1-inch IPS; Eye/Face Wash 2-inch IPS.

D. Water Supply: Minimum 25-gallon holding tank mounted in building rafters.

E. Waste Outlet: 2-inch

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of all materials and equipment shall be completed in a workmanlike manner using craftsmen skilled in their respective trades. The Contractor shall provide work that has a neat and finished appearance.

B. Installation shall be in accordance with the manufacturer's instructions and approval after inspection and prior to operation. The Contractor shall keep a copy of the manufacturer's installation instructions available on the job site at all times for review. The Contractor shall notify the Owner/Owner's Representative of any conflict that arises between the manufacturer's instructions, codes or regulations and the Contract Documents.

C. Instrumentation and controls shall be installed and tested under the supervision of a qualified service representative(s).

3.02 TESTING

A. All equipment shall be field tested to demonstrate that it provides the required functions.

B. All equipment and piping shall be tested hydrostatically or pneumatically for leaks at 150% of the working pressure and/or vacuum. Any deficiencies shall be corrected and the tests shall be re-conducted.

C. The Contractor shall notify the Owner/Owner's Representative one (1) week in advance of any field-testing.

D. Control system shall receive dynamic loop tests, which shall conform to the intent of ISA-S26.

E. The Contractor shall adjust instruments and equipment to obtain the best working condition for a dynamic system and demonstrate the same to the Owner/Owner's

Representative. Submit a typewritten final record of all adjustment/set points to the Owner/Owner's Representative for final verification/information.

3.03 PERFORMANCE TEST REQUIREMENTS

During start-up and testing, all equipment components in the Equipment Building and the Satellite Pumphouse Enclosures shall be subjected to performance tests. Performance testing shall be performed in accordance with the manufacturers recommended start-up procedures, as appropriate. In accordance with Section 1.03 of this specification, the Contractor shall provide the Owner/Owner's Representative with the recommended start-up and performance testing procedures prior to initiation of construction activities.

3.04 PROCESS DEVELOPMENT:

The Contractor shall be responsible for any process modifications or development needed to achieve the required performance standards set forth in the Specifications and document any such modifications on drawings or other suitable documents which shall be submitted to the Owner/Owner's Representative for both information and review.

END OF SECTION 15000

SECTION 15050
PIPE, TUBING AND VALVES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

The Contractor shall furnish, install and test all pipes, valves and accessories for the DNAPL Recovery System as identified in the Contract Drawings and specified in the Contract Documents.

1.02 APPLICABLE STANDARDS:

Piping and accessories shall comply with ANSI, ASTM, ASME, AWWA, ISA and all other applicable Federal, State and local codes including revisions to date of the Contract.

1.03 GENERAL REQUIREMENTS:

A. Standard Products: Piping, tubing, and valves and accessories shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use under similar duty for at least 5 years. The materials shall be supported by a service organization that is, in the opinion of the Owner/Owner's Representative, reasonably convenient to the site.

B. Identification: All pipe and tubing shall be identified as to the following: pipe class, date of manufacture, manufacturer's name or logo, inside pipe diameter, and pipe material. All valves shall be identified as to following: manufacturer, size, date of manufacture, flow direction arrow.

C. Verification of Dimensions: The Contractor shall become familiar with all details of work, verify all dimensions in the field, and shall advise the Owner/Owner's Representative of any discrepancies before performing work.

1.04 SUBMITTALS:

The Contractor's submittals shall include, but not limited to, the following:

A. Pipe, tubing and valve schedules including size, type, style and materials of construction.

B. Drawings showing proposed layout anchorage, and supports for piping and valves.

C. Manufacturer's descriptive and technical literature, including catalog cuts.

A. The Contractor shall furnish and set sleeves for all piping and tubing that passes through walls.

B. Sleeves for pipes 4 inches and smaller shall be at least two (2) pipe sizes larger. The space around all pipes shall be packed with mechanical seals or other approved flexible watertight materials. Sleeves for insulated piping shall be sized after pipe insulation is complete.

2.04 VALVES

xxxelectronically actuated solenoids

A. Ball Valves:
   1. Type: Flanged, Trunnion Ball, 150 psi.
   2. Materials of Construction: TEFZEL lined ductile Iron, RTFE seals, TFE seals.
   3. Manufacturer and Model: ITT Eng. Valves, Figure No. 1059, :1/2" to 2", or approved equivalent.
   4. Operator: Wrench through 6".

B. Check Values:
   1. Type: Flanged, Ball, 150 psi
   2. Materials of Construction: FEP, PVDF or TFE lined ductile iron or plastic.
   3. Manufacturer & Model: Performance Plastics, Model 770, 1" to 8" Grinnel (Neotecku), KRV-S, 2 " to 8" or approved equivalent.
   4. Operator:
      a. on/off - spring actuated lever through 4" gear operator 6" and larger.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: All pipe valves and fittings shall be inspected for soundness and be cleaned of all dirt and other foreign matter before installation. Any damaged and/or broken pieces shall be rejected.

B. Piping shall be installed in the most direct, straight and mechanically sound manner possible. All vertical lines shall be plumb, and horizontal lines shall run parallel to building walls. Piping shall be continuous between fittings with offsets around obstructions as required. Piping over electrical equipment shall be avoided wherever practicable. No piping shall pass through walls at other than 90 degrees.

C. All piping shall be installed as close to the walls as is consistent with good workmanship. No piping shall be installed in a manner that will interfere with doorways or door operation, ventilation equipment, lighting, outlets or other proposed equipment. Whenever pipe requires cutting, it shall be done with an

approved pipe cutter in such a manner as to leave a smooth end at right angles to the axis of the pipe.

D. At the end of each day's work and otherwise as required and/or directed, the Contractor shall provide caps and/or plugs in all openings in piping for protection. Particular attention must be given to avoiding the possibility of any foreign material entering the pipes.

E. Flanged connections required to match connecting flanges on equipment and valves shall be assembled with proper gaskets and bolting. Gaskets shall be centered on face of flange and be aligned true and square before bolting. All gasket materials must be compatible with DNAPL constituents and approved by Owner/Owner's Representative. Bolting shall conform to the ANSI code for Pressure Piping.

F. Pipe, valves and appurtenances shall be installed in accordance with manufacturer's instructions.

G. All valves shall be installed so that operators may be conveniently turned but without interfering with access.

H. Valves on aboveground piping shall be supported on both sides.

3.02 TESTING:

A. General:

1. Notify Owner/Owner's Representative two (2) work days in advance of testing.
2. Provide all testing apparatus including pumps, hoses, gauges, fittings, temporary bulkheads, plugs, compressors and miscellaneous other required items.
3. Provide temporary blocking and bracing or approved thrust and joint restraint to prevent joint separation and pipe movement during testing.
4. All blind flanges, bulkheads, plugs and end caps shall be in place during testing.
5. Pipelines shall hold the specified test pressure for a time period as specified herein.
6. Pipelines that fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.
7. Required test pressures apply to the lowest elevation of the pipeline section being tested, unless otherwise specified.
8. Unless otherwise approved, conduct all tests in the presence of the Owner/Owner's Representative.
9. All tests shall be repeated until the test conditions are satisfied.
10. Water Source:

a. Contractor shall make all arrangements for and bear all expenses for providing all potable water require for testing, flushing and other potable water uses. The source of the water shall be subject to the approval of the Owner/Owner's Representative.

b. The point of introduction of water for conducting tests shall be subject to the approval of the Owner/Owner's Representative.

c. Contractor shall be responsible for transfer of water to Detrex Corporation storm sewer system for treatment and disposal.

11. All costs for tests shall be included in the work.

B. Pressure Testing:

1. The Contractor shall be responsible for pressure testing all SVE piping and DNAPL collection tubing within the equipment building, within the satellite pumphouses, from the recovery wells to the pumphouses, and from the pumphouses to the equipment building.
2. Pipe shall be hydrostatically (water) or pneumatically (air) tested.
3. Piping shall be tested at a pressure of 100 psig.
4. The tests shall be made when the pipe and appurtenances have been installed. The pressure testing and leakage inspection shall be conducted simultaneously.
5. The duration of the test shall be four (4) hours for hydrostatic tests and one (1) hour for pneumatic tests.
6. All exposed pipes, fittings, joints, and other appurtenances shall be carefully examined during the partially open trench test. All joints showing visible leaks shall be repaired and made tight. Any cracked or defective pipe, tubing or fitting discovered as a result of the pressure tests shall be removed and replaced by the Contractor with new sound material, and the pressure test shall be repeated.
7. Allowable leakage rates (in gallons per 1,000 feet per inch diameter) shall be in accordance with manufacturer's recommendations and approved by the Owner/Owner's Representative prior to testing.
8. If, during the test duration, the pressure varies significantly or a significantly lower but constant pressure is maintained, the Contractor shall inspect the line for leakage. All leaks shall be repaired using approved means. If no leakage is found, the test shall be repeated.
9. The test results shall be to the satisfaction of the Owner/Owner's Representative prior to acceptance of the pipe installation.
10. Ends of sections being tested shall be tightly closed by plugs, blind flanges, gates, or other approved means for the duration of the tests. The Contractor shall furnish all material, supplies, apparatus, labor, and equipment as necessary for carrying out the tests, and shall make all necessary arrangements for securing and furnishing water for test purposes. Proposed test procedures, if they vary from those specified, shall be submitted to and approved by the Owner/Owner's Representative prior to testing.

11. Water used in testing or flushing the piping system shall be disposed as described hereinafter.
12. Gauges shall be certified for accuracy.

C. Visual Inspection: Prior to final acceptance, a visual inspection of all appurtenance structures will be required. Any visual leaks, regardless of their magnitude, shall be repaired by the Contractor.

END OF SECTION 15050

Division 16
Electrical

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic electrical requirements specifically applicable to Division 16 sections in addition to the Contract Documents and Contract Drawings

B. Provide all materials and equipment necessary for the proper installation or operation of the systems, and related grounding system, even though not mentioned in the Contract Documents, but which are reasonably implied or usually incorporated to make up a complete system.

C. Layout of equipment, fixtures, conduit, specialties, and accessories are generally diagrammatic unless specifically stated otherwise.

D. Provide any restoration associated with electrical installation.

1.02 DEFINITIONS

ANSI	American National Standards Institute
NEC	National Electrical Code (Latest Revision)
NEMA	National Electrical Manufacturers Association
UL	Underwriters Laboratory

1.03 QUALITY ASSURANCE

A. All material and equipment shall:
   1. Bear the label of the Underwriters Laboratories (U.L.)
   2. Conform with the standards of the National Electrical Manufacturers Association (NEMA) and the American National Standards Institute (ANSI) for the use intended.

B. All material and equipment provided shall conform to the National Electric Code and the current editions of all standards, codes, ordinances, rules and regulations which apply to the work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Coordinate material and equipment delivery with the project schedule.

B. Notify the Owner's Representative immediately, in writing, if material or equipment delivery will adversely affect the project schedule, include

documentation from equipment suppliers indicating the revised delivery dates and the reason for the delay.

C. Exercise care during loading, transporting, unloading and handling of materials to prevent damage.

D. Check for defective or damaged materials and for incomplete shipments after equipment delivery to the project site.

E. Store materials and equipment on the construction site in enclosures or under protective covering to keep it clean, dry and undamaged.

F. Replace or repair, to the satisfaction of the Owner's Representative, all defective or damaged materials and equipment at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment furnished under this Contract shall be the latest standard products of manufacturers regularly engaged in the manufacturing of such products, shall meet the requirements of NEMA and ANSI standards, and the latest edition of the National Electric Code.

B. Provide all hardware, supports, hangers and accessories for proper installation of apparatus, materials and equipment from roof joists, walls and posts using all necessary plates, bridging, inserts and expansion shields as required.

C. Where exposed conduits pass through walls, escutcheons shall be provided to cover the opening and sleeve completely. All escutcheons shall fit tight to the wall.

D. Provide all "power" wiring, connections and motor starters for all equipment and operations for the entire project. Starter sizes, starter types, protective device sizes, conductor and conduit sizes, holding coil and control voltages shall be provided and shall match the requirements of the equipment, systems and devices. No additional compensation will be allowed for modifications required due to equipment and device sizes, ratings, etc. which differ from those of the specified equipment.

E. Provide all conduit, conductors, junction boxes, accessories, and connections as required for complete and fully operational devices and equipment.

PART 3 - EXECUTION

3.01 PROCEDURE

A. Coordinate with the work of the Utility Companies and with the work of other trades/contractors. Schedule work to avoid delay in installation and completion of interrelated work.

B. Field verify all measurements, distances, etc. at the project location.

C. Precautions shall be taken to protect incomplete work. All equipment or conduit not stable during construction shall be thoroughly braced or otherwise protected.

D. Upon completion of the installation and testing, the Electrical Contractor shall furnish the necessary skilled labor/technician for instructing the Owner's Representative in the operation of the different systems and equipment, for one (1) eight (8) hour day per system as a minimum, unless otherwise specified or noted. The date of starting of the instruction period shall be determined by the Owner's Representative following the notice of completion of work and test by the contractor.

3.02 PROTECTION OF BUILDING

The Contractor shall be responsible for any damage to his work or the work of others caused by his forces and shall repair any damage done to the work, and leave the building premises clean and in good order and repair at the termination of the Contract.

3.03 INTERFERENCE

Refer to the other Contract Documents before installing any work and check for possible interferences. If any work is so installed, and it later develops interference with other features this Contractor, at his own expense, shall make such changes in his work to eliminate the interference.

3.04 MAINTENANCE OF SERVICES AND EQUIPMENT

A. Maintain all equipment and systems installed until final acceptance by the Owner, and take such measures as necessary to insure adequate protection of all equipment and materials during delivery, storage, installation and shutdown conditions. This responsibility shall include all provisions to meet the conditions incidental to the delays pending final test of systems and equipment under seasonal conditions.

B. Operate the completed systems for a period of time in the presence of the Owner's Representative to determine the capability of the equipment and controls to conform to the requirements of the Contract Documents.

END OF SECTION 16010

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Conduits and Accessories.

B. Conductors, Cables and Wiring Connections.

C. Enclosures, Cabinets, Pull, Junction and Outlet Boxes.

D. Wiring Devices.

E. Equipment Identification.

F. Equipment Support and Mounting.

1.02 APPLICABLE STANDARDS

A. The material, equipment and associated accessories provided shall meet or exceed the applicable requirements of the following standards and specifications:
   1. UL.
   2. NEMA.
   3. ANSI.
   4. NFPA.

1.03 QUALITY ASSURANCE

A. Equipment and materials for which Underwriters' Laboratories, Inc. (UL) provides a product listing, shall be listed and labeled.

B. Materials and equipment furnished under this contract shall be the latest standard products of manufacturers regularly engaged in the manufacturing of such material or equipment as one of their principal products and shall comply with the requirements specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Provide all basic materials and accessories required for the proper installation and operation of the electrical systems.

B. Circuit designations in the form of "Home Runs" indicate the designation of the branch circuit and the panelboard or motor control center from which the branch circuit is served; these designations may be modified subject to field conditions and approval by the.

C. Conduit
   1. Acceptable Manufacturers:
      a Allied Tube and Conduit, Triangle PWC Inc., V.A.W. of America Inc., Wheatland Tube.
      b OCAL, Robroy Industries
      c Anaconda, AFC, Electri-Flex Co., Kellems
      d Alumax Extrusions, Anamet Inc.
      e Carlon, Queen City Plastics Inc.
   2. Rigid galvanized steel (RGS) conduit shall be manufactured from heavy wall steel, hot-dipped galvanized on the exterior and interior, in accordance with UL standard 6 and ANSI C80.1.
   3. Non-metallic, polyvinyl chloride (PVC) conduit shall be sunlight resistant, Schedule 40, heavy wall, rigid non-metallic conduit for above ground and underground installations manufactured in accordance with NEMA TC-2 and WC-1094 requirements.

D. Conduit Connectors, Couplings and Fittings
   1. Acceptable Manufacturers: All connectors, couplings, fittings and accessories shall be of the same type and as manufactured by the associated raceway or conduit manufacturer.
   2. Rigid galvanized steel, PVC coated rigid galvanized steel, intermediate metal conduit and rigid aluminum conduit connectors, couplings and fittings shall be fully threaded and shall be of the same material as the respective conduit system.
   3. Non-metallic, PVC conduit connectors, couplings and fittings shall be constructed of Schedule 40, rigid, heavy wall, non-metallic PVC in accordance with NEMA TC-3 requirements.
   4. Expansion fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands.

E. Conductors, Cables (600 volts and under) and Accessories
   1. Acceptable manufacturers:
      a. AFC [AC & MC Cable]
      b. American Insulated Wire Corp
      c. The Okonite Company
      d. Phillips
      e. Rome Cable
      f. Southwire Company

2. All conductors shall be insulated for 600 volts and shall be standard AWG and MCM sizes. Conductors shall be 98 percent copper, thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Minimum conductor size shall be #12 AWG, except smaller sizes may be used for control, communication and other special systems. Conductors shall be marked with the manufacturer's name, wire size and insulation type.

F. Equipment Enclosures and Cabinets
   1. Acceptable manufacturers:
      a Hennessey
      b Hoffman
      c Square D
   2. Interior enclosures and cabinets shall be constructed of code gauge galvanized steel. Boxes and fronts shall match standard branch circuit panelboards in appearance and dimensions.
   3. Exterior enclosures shall be NEMA 4 rated and shall be provided with a strip heater sized to maintain 50°F within the enclosure. The Strip heater shall be 120 volt. Provide a control transformer as required.

G. Pull, Junction and Outlet Boxes
   1. Acceptable manufacturers:
      a American Electric
      b Appleton
      c Hoffman
      d Keystone
   2. Minimum box sizes shall be as indicated in Article 370 of the National Electrical Code for the conductors and devices installed and shall be appropriate and approved for the environmental condition of the location where they will be installed.
   3. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location where they will be installed. Provide screw-on type covers.
   4. Pull and junction boxes installed in outdoor locations shall be of raintight construction with gasket covers and threaded conduit hubs.
   5. Metal outlet boxes and cover plates shall be galvanized steel, not less than 1-1/2 inch deep, 4 inch square or octagonal, with knockouts and mating device cover plates as required.
   6. Non-metallic outlet boxes and cover plates shall be schedule 40, molded PVC complete with hubs and gasketed, screw fastened covers.

H. Structural Support Channel
   1. Acceptable manufacturers:
      a Unistrut Corp.
      b American Electric

2. Shall be 12 gauge minimum, galvanized steel, 1-5/8 inch square, with incidentals as required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Unless otherwise noted, wiring for all systems shall consist of insulated conductors installed in conduits. Conduits shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond conduits to all boxes and cabinets such that each system of conduits will be electrically continuous throughout.

1. Coordinate the work of other contractors, trades and utility companies and schedule to avoid interference and delays in installation or completion of any interrelated work. All measurements, levels, etc. shall be verified by the Contractor.
3. Refer to all contract documents before installing any work and check for possible interference. If any work is so installed and later develops interference with other features of the design, the Contractor shall remedy his work to eliminate the interference.
4. All interconnecting control wiring for systems, equipment and operations provided by others, unless specifically indicated otherwise in the Contract Documents, shall be provided by the Contractor or trade supplying the system, equipment or operation.
5. Arrange for and provide to the Owner/Owner's Representative a Board of Fire Underwriters, or other approved agency, inspection of the completed work.

B. Conduit

1. Where sizes are not indicated, conduits shall be sized per the National Electrical Code in accordance with the quantity, size, type and insulation of conductors to be installed; however, conduits shall be minimum one-half inch (1/2") trade size for branch circuit wiring and minimum three-quarter (3/4") trade size for all, instrumentation system and for all branch circuit "Home Runs" to panelboards.
2. All conduits shall provide a continuous ground between all outlets and the established electrical system ground.
3. Provide square cut conduits (free of burrs due to field cutting or manufacture), brushed where necessary.
4. Provide conduits with exterior surfaces not less than six inches (6") from any surface with normal operating temperature of 200 degrees Fahrenheit or higher.
5. Provide plugged ends of each roughed-in conduit with an approved cap or disc to prevent the entrance of foreign materials during construction.
6. Provide conduits parallel or perpendicular to floors, walls and ceilings where exposed wiring is permitted.

7. Provide conduits with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the conduit.
8. Provide conduits with raintight and concrete-tight couplings and connectors.
9. Conduits shall be firmly fastened within three feet of each outlet box, junction box, cabinet or fitting. Conduits shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as piping, etc.
10. Expansion fittings shall be provided so that no undue stress is placed on any electrical conduit due to the minor settlement of the Equipment Building or the Satellite Pumphouse Enclosures.
11. All conduits shall be supported adequately by pipe clamps or other approved methods. In exterior locations, supports shall allow not less than ¼ inch air space between conduit and wall. Firmly fasten conduit within 3 feet of each outlet box, junction box, cabinet or fitting.
12. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equivalent protection to conductors. Provide grounding type insulated bushings on all conduit sizes one and one-quarter inch (1-1/4") trade size and larger, and on all feeder raceways regardless of size. Provide standard bushings for conduits one inch (1") and smaller.
13. Where exposed conduits pass through walls escutcheons shall be provided to cover the opening and sleeve completely. All escutcheons shall fit tight to the wall.

C. Provide all wiring in the following applicable conduit system:
1 Wiring 600 volts or less in dry locations: Galvanized electrical metallic tubing, galvanized intermediate metal conduit, rigid heavy wall aluminum conduit or galvanized rigid heavy wall steel conduit.
2. Wiring 600 volts or less provided in indoor or outdoor wet locations: Schedule 40 PVC conduit with properly sized ground wire.
3. Flexible metal conduit shall be used for final connection to all motors, AND final connection to rotating or vibrating equipment. Liquid-tight flexible conduit shall be used in all wet or damp locations minimum one-half inch (1/2") trade size. Maximum length of flexible conduit shall be 36 inches, except that from outlet boxes to lighting fixture maximum length shall be 6 feet. AC and MC flexible type cables may be used for other wiring only when permitted in writing by the Owner/Owner's Representative.

E. Wiring Methods
1. Conductors shall not be installed until conduits system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades that may cause conductor damage is completed.

Use cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.

2. In general, conductors shall be the same size from the last protective device to the load.
3. All wiring systems shall be properly grounded and continuously polarized throughout, following the color coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.
4. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs.
5. For splices and taps, No. 10 AWG and smaller, use solderless "Twist on" connectors having spiral steel spring and insulated with a vinyl cap and skirt.
6. For splices and taps, No. 8 and larger, use solderless "Split Bolt" type connectors.
7. Use cast connections for ground conductors.
8. Make all splices and connections in accessible boxes and cabinets only.
9. Cover uninsulated splices, joints and free ends of conductor with rubber and friction tape or PVC electrical tape. Plastic insulating caps may serve as insulation.
10. On termination at branch circuit outlets, leave a minimum of eight inches (8") free conductor for installation of devices and fixtures.
11. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner/Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.
12. Conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equivalent.
13. Lighting fixtures shall be installed with exposed wiring after equipment, piping, etc., are in place. Where conflicts exist, locate lights for best light distribution after notifying Owner/Owner's Representative.
14. Motor Terminals and Similar Bolted Connections for Wire and Cable #12 AWG and Above
    a. Use proper size pressure type eyelugs on stranded conductors. Form a circular loop in bare solid conductors.
    b. Bolt lugs together back to back using the proper size bolt with a flat washer placed under the bolt head and a lock washer placed under the nut. The bolt shall be cut off as short as possible and cleaned of any sharp edges.
    c. First, insulate with a friction tape starting at end of conductor insulation without covering conductor insulation to eliminate sharp edges and voids. Second, tape over all with vinyl plastic tape until it extends a short distance beyond the end, turn tape

over end and wind back to starting point. Pull tape as tightly as possible on each turn and continue taping to a thickness equal to one-and-one-half times the thickness of the original conductor covering.

F. Junction and Pull Boxes

Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, and the like. Provide all necessary junction or pull boxes required due to field conditions.

G. Outlet Boxes

1. A minimum of two outlet boxes will be installed in the Equipment Building in locations designated by the Owner/Owner's representative. One outlet boxes will be installed in each of the Satellite Pumphouse Enclosures.
2. All outlet boxes shall be NEMA 4-rated and shall be sized to accommodate the wiring device(s) to be installed.

H. Identification

1. All motor control centers, panelboards, etc. shall have identification tags, mounted adjacent to the manufacturer's nameplate, indicating the equipment's designation and identification number per the Contract Documents.
2. All motor control center devices, individually mounted motor controllers, disconnect switches, control devices, etc. shall be provided with identification tags indicating the equipment that they serve or control per the equipment designation and identification number indicated in the Contract Documents.
3. Power conductors shall be continuously polarized and color coded throughout using the following scheme:
   a. White - All neutral conductors, 600/120V systems
   b. Green - All ground conductors
   c. Phase Conductors -

600/120V	Systems
	Phase A - Black
	Phase B - Red
	Phase C - Blue

   For conductors No. 8 and smaller, color coding shall correspond to the color of the conductor insulation. For color coding of wire larger than No. 8, use self-adhesive, wraparound type markers shall be used. These markers shall be used at all panelboards, junction boxes, disconnect switches, circuit breakers, etc.
4. Control conductors shall be identified using numerical tags corresponding to conductor designations indicated on approved shop drawings of schematic diagrams, and as required for clarification of

system and equipment connections. Conductors shall be clearly identified at each terminal block, equipment connection and junction.

I. Equipment Support and Mounting

1. Provide all supports and hangers for proper installation of apparatus, materials and equipment from roof and wall construction using all necessary plates, bridging, inserts and expansion shields as required.
2. Equipment Mounting Heights: Where structural or other interference prevent compliance with mounting heights listed below, notify Owner/Owner's Representative before changing location. Unless otherwise directed, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:
   a. Toggle switches (up position "on") 48"
   b. Receptacle outlets (long dimension vertical, ground pole nearest floor) 48"
   c. Receptacle outlets, weatherproof, above grade 24"
   d. Disconnect switches, motor starters 48" adjustable frequency drives
3. Racks for support of conduit and heavy electrical equipment shall be secured to building construction by substantial structural supports.

3.02 TESTS

A. Tests and procedures prior to start-up:

1. All equipment and materials shall be clean, dry and free of foreign materials. All screw and bolt connections shall be checked for tightness.
2. Conductor connections and terminations, and all bus bar connections shall be checked for proper tightness and continuity.
3. Test the grounding system to assure continuity and to assure that resistance to ground does not exceed specified limits.

B. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform properly.

C. Demonstration of Complete Electrical Systems

1. The Owner will assume no liability or responsibility for any portions of the installation under this contract until they are demonstrated and accepted in writing. Final demonstrations shall be made only after the Owner/Owner's Representative is satisfied that the work has been completed in accordance with the intent of the Contract Documents.
2. After the electrical system is completed, and when directed by the Owner/Owner's Representative, demonstrate the total system operation and make final adjustments to the system. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration as directed by the Owner/Owner's Representative.

3. Pay all charges or fees, including the cost of any special test equipment, factory engineers, etc. necessary for the proper performance of the specified tests, demonstrations and instructions.
4. All demonstrations and instructions referred to shall be scheduled at the convenience of the Owner/Owner's Representative and in no case shall be scheduled without at least seventy-two (72) hours notice.

D. Provide additional testing as indicated in related sections in the Contract Documents.

3.03 CLEANING

A. Upon completion of the work, remove all refuse and surplus materials and leave the premises neat and clean.

B. Clean all equipment surfaces and touch up all damaged surfaces to the satisfaction of the Owner/Owner's Representative.

END OF SECTION 16050

SECTION 16450
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Provide grounding electrodes, conductors, connections, hardware and bonding as required for proper and complete electrical system and equipment grounding.

1.02 SUBMITTALS

Test Report: Submit test report which indicates overall resistance to ground and resistance of each electrode.

1.03 QUALITY ASSURANCE

A. All grounding system components and hardware shall be UL labeled and listed.

B. The grounding system components and hardware furnished under this specification shall be the standard product of a manufacturer with established reputation and experience and who shall have produced the specified components and hardware for a minimum of three years.

C. The grounding system and bonding shall meet or exceed the requirements of Article 250 of the latest edition of the National Electric Code (NFPA 70). In the event of a conflict or discrepancy with NEC Article 250, the more stringent requirement shall apply.

D. The grounding system resistance to ground shall be 25 ohms or less.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Burndy Corp.

B. Cadweld

C. Erico Products Inc.

D. OZ/Gedney Co.

E. Thermoweld

F. Thomas & Betts

2.02 GROUND RODS

Ground rods shall be copper coated steel at least 5/8" in diameter and 10 feet long. The rods shall have a hard, clean, smooth, continuous surface throughout the length of the rod. Each ground rod shall be die-stamped near the top with the name or trademark of the manufacturer and the length of the rod in feet.

2.03 CONDUCTORS

A. Grounding and bonding conductors, cables and braided straps shall be bare, stranded, electrical grade, copper sized as indicated in the contract documents or as required by NEC Article 250, whichever requirement is more stringent. Bonding jumpers shall have a cross-sectional area at least equal to the associated grounding conductor.

B. Provide grounding and bonding conductors and cables with insulation type and color as specified and indicated; conductors and cables shall be same make as for 600 volt conductors.

2.04 CLAMPS, CONNECTORS, LUGS, TERMINALS AND HARDWARE

A. Provide solderless ground clamps, connectors and hardware made of corrosion resistant silicon-bronze as required; clamps, connectors and hardware shall be suitable for direct burial.

B. Provide solderless lugs and terminals constructed of copper as required; lugs and terminals shall be two hole type for conductor sizes #1/0 and larger.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Install all grounding system components and hardware in accordance with manufacturer's instructions and NEC Article 250.
2. Install all grounding system cables and conductors with enough slack to prevent undue stress and/or breaking.
3. Grounding conductors or cables subject to abrasion or mechanical damage shall be installed in rigid metal conduit.
4. All grounding conductors shall be installed in one continuous length without splice or joint.
5. All bonding or grounding conductors shall be terminated in a listed lug that shall be bolted or screwed to a fixed metallic portion of the building structure or equipment enclosure.

6. All surfaces at points of grounding connection shall be thoroughly cleaned and buffed just prior to making the connection.
7. Grounding conductors that pass through floor slabs, walls, etc., unprotected shall be installed in Schedule 40 PVC conduit sleeves.

B. Building Structure Grounding

1. Do not install ground rods and ground ring conductors in cinder fill or backfill with soil containing corrosive materials.
2. Install ground rods around perimeter of building in locations indicated; install additional ground rods as required to achieve resistance to ground specified. Ground rods shall be driven to a depth such that the top of the ground rod is 24" below finished grade.
3. Install a bare copper ground ring conductor, size as indicated, around the perimeter of the building 30" below finished grade. The ground conductor shall be connected to each ground rod by a "cadwelded" connection.
4. Install a bare copper bonding conductor, size as indicated, from the ground ring conductor to each steel building column. The bonding conductor shall be "cadwelded' to the column and connected to the ground ring conductor by a "cadwelded' connection or listed connector.

C. Electrical System Grounding

1. The electrical service shall be effectively grounded by bonding together the Motor Control Center (MCC) and the made grounding electrode. The grounding electrode and bonding conductors shall be sized as indicated or as required by NEC Articles 230 and 250, whichever is more stringent.
2. Separately derived alternating current systems shall be bonded and grounded ahead of any disconnecting or overcurrent device. The grounding electrode and conductor shall be the nearest effectively grounded metal structure or water pipe or other approved made grounding electrodes.
3. Do not install ground rods and grounding electrode conductors in cinder fill or backfill with soil containing corrosive materials.
4. Provide a made grounding electrode as detailed in location(s) indicated; install additional ground rods as required to achieve the resistance to ground specified. Ground rods shall be driven to a depth such that the top of the ground rod is 24" below finished grade.

D. Equipment and Device Grounding

1. Each feeder and branch circuit shall be provided with a green, or bare, grounding conductor, sized as indicated, and installed in the associated

raceway or conduit. Each grounding conductor shall be terminated on a suitable and approved lug, bus, or bushing.

2. All feeder raceways shall be bonded to all associated panelboards. Where multiple feeder raceways enter a common enclosure or box, all the feeder raceways shall be bonded together as well, as to the box.
3. Terminations of all metallic raceways at panelboard, disconnect switches, equipment enclosures, junction boxes, cabinets, etc., shall be provided with grounding type bushings; except insulated type bushings shall be provided where required by the NEC.
4. All raceway systems, panelboards, disconnect switches, starters, junction boxes, metal enclosures, motor frames, steel supports, etc., shall be effectively grounded.
5. Conduits which run to enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and impair the electrical connection to ground shall be provided with approved bonding jumpers.
6. Bonding jumpers shall consist of a stranded or braided copper wire sized in accordance with NEC Article 250. The bonding jumper shall be connected from the grounding bushing on the conduit to a ground bus stud or corrosion resistant alloy bolt in the enclosure.
7. Raceway, conduit, bus expansion joints and telescoping sections not thoroughly bonded shall be provided with approved bonding jumpers not less than #8 awg stranded bare copper.
8. All flexible metal conduit, liquid tight conduit and Type MC cable shall be provided with a continuous, stranded, copper grounding conductor in addition to the metallic sheath. The grounding conductor shall be sized as indicated or required by NEC Article 250, but shall not be less than #12 awg.

E. TESTS

1. Measure, record, and submit value of building structure ground resistance and the made electrode ground resistance to earth prior to any connections to equipment, building steel, or water service.
2. Measure, record, and submit value of building structure ground resistance and the made electrode ground resistance after all connections have been made.

END OF SECTION 16450

SECTION 16470
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Branch circuit panelboard (designated as P-1) on the contract drawings.

1.02 APPLICABLE STANDARDS

A. The panelboard and associated circuit breakers provided shall meet or exceed the following standards and specifications.
   1. UL 50 - cabinets and boxes
   2. UL 67 - panelboards
   3. UL 489 - circuit breakers
   4. NEMA AB-1 - circuit breakers
   5. NEMA PB-1 - panelboards
   6. US Federal Spec. W-P-115b - panelboards
   7. US Federal Spec. W-C375b - general circuit breakers

1.03 SUBMITTALS

A. Product shop drawings and data: Submit manufacturer's shop drawings and technical product data for each panelboard required.

B. Panelboard type shall be submitted in a single complete brochure, which shall be in the form of a soft cover binder. Information on each panelboard type shall include:
   1. Manufacturer and Catalog Number
   2. Dimensioned Construction Drawings
   3. Standard Catalog "Cut" Sheets
   4. Voltage, Current and Short-circuit interrupting Ratings
   5. Enumeration of each circuit breaker including trip rating, number of poles, interrupting rating and arrangement within the panelboard.
   6. Bus type, arrangement and Lug Location
   7. Description of Accessories

1.04 DELIVERY, STORAGE AND HANDLING

A. Panelboard shall be delivered with UL and manufacturer's labels intact and legible. Missing, broken, bent and damaged equipment and materials shall be replaced with new equipment and materials. The panelboard shall be stored in protected, dry location. Panelboard shall be protected from dust, dampness, paint and cleaning solvents during all phases of construction.

1.05 QUALITY ASSURANCE

A. All materials and equipment supplied under this Specification shall be new, shall bear the seal of the Underwriters Laboratory or other nationally recognized testing laboratory and shall be installed in a neat, craftsmanlike manner.

B. All materials and equipment supplied under this specification shall meet or exceed the standards and specifications indicated in 1.02 above. Whenever a conflict between codes, standards, rules or regulations occurs, the more stringent shall govern.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square D

2.02 MATERIALS AND EQUIPMENT

A. Panelboard shall be of dead front type construction, factory-assembled from code gauge steel in accordance with UL and NEMA standards. The box shall be NEMA Type 12, constructed of corrosion-resistant, galvanized steel with at least National Electric Code minimum gutter space and furnished with standard knock-outs in the endwalls.

B. Panelboard shall be provided with the Motor Control Center and shall have front constructed of code gauge, cold-rolled steel with a factory-painted ANSI-61 powder coat finish applied over a rust inhibitor. The panelboard front shall be equipped with a single door with concealed hinges, trim adjusting screws and corrosion resistant cylinder lock and catch assembly. A directory frame with clear plastic protection for the directory shall be included and permanently mounted on the inside of the door. The directory shall be typewritten.

C. Panelboard interior shall be factory assembled on rigid steel frames and shall have insulating base assemblies providing breaker mounting and bus bar insulation. Panelboard shall have fully rated phase and neutral bussing as indicated and shall be provided with a ground bus sized per the National Electric Code.

D. The panelboard shall be supplied with molded-case, bolt-on type, thermal magnetic trip, circuit breakers with the ratings and poles indicated. The circuit breakers shall be quick-make, quick-break, trip indicating type with the trip accessories indicated (ground fault trip, shunt trip, etc.). All two and three pole circuit breakers shall have a single handle with internal common trips.

E. Panelboard shall be 225 amp main lug only indicated on the panelboard schedule.

F. Panelboard and circuit breakers shall be fully rated for the interrupting and withstand rating shown on the panelboard schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboard shall be provided with the Motor Control Center. It shall be factory installed by the Motor Control Center manufacture.

B. All unused panelboard conduit and circuit breaker openings shall be closed-off with approved devices.

3.02 Identification:

A. Install on the front of each panelboard, a phenolic tag indicating the panelboard designation as shown on the contract drawings.

B. Provide and mount under plastic in each panelboard directory frame, a neatly type written directory identifying the branch circuit devices and the circuits, devices and areas which they serve.

3.03 CLEANING

A. Touch-up scratched or marred surfaces to match original finish.

END OF SECTION 16470

SECTION 16490
MOTOR CONTROL CENTER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide Motor Control Center MCC and motor starters as required.

1.02 APPLICABLE STANDARDS

A. The Motor Control Center and associated equipment shall meet or exceed the following standards and specifications.
   1. National Electrical Manufacturer's Association (NEMA)
   2. American National Standards Institute (ANSI)
   3. National Electrical Code (NEC) - National Fire Protection Association 70
   4. Underwriters Laboratories (U.L.)

1.03 SUBMITTALS

A. Product shop drawings and data: Submit manufacturer's shop drawings and technical product data for each panelboard required.

B. The motor control shall be submitted as a complete system (standard diagrams will not be accepted). Include the following:
   1. Composite layout dimensioned drawings for the motor control unit.
   2. Overall layout diagram showing all of its internal equipment.
   3. Power and control wiring schematic diagrams.
   4. External connection terminal block layout and connections.
   5. Provisions for incoming feeder cables.
   6. Voltage rating, continuous current and short circuit rating.
   7. Enumeration of motor control units, including number of poles, NEMA size, voltage rating, current rating, interrupting capacity and accessories. Identify each unit for use with corresponding motor.
   8. Details of any modifications or equipment required.

C. Product Data: Manufacturer's catalog sheets.

D. Maintenance Data and Operating Instructions.

E. Maintenance Material (Extra Stock): Deliver to facility personnel through the Engineer 30 percent spare lamps for indicating (pilot) lights.

1.04 DELIVERY, STORAGE AND HANDLING

A. MCC shall be delivered with UL and manufacturer's labels intact and legible. Missing, broken, bent and damaged equipment and materials shall be replaced with new equipment and materials. The MCC shall be stored in protected, dry location in their original unbroken package or container. MCC shall be protected from dust, dampness, paint and cleaning solvents during all phases of construction.

B. Protection: Provide supplemental heating devices, such as incandescent lamps or low wattage heaters, under the protective cover of motor control unit to control dampness, from the time equipment is delivered to the site until it is energized.

1.05 QUALITY ASSURANCE

A. All materials and equipment supplied under this Specification shall be new, shall bear the seal of the Underwriters Laboratory or other nationally recognized testing laboratory and shall be installed in a neat, craftsmanlike manner.

B. All materials and equipment supplied under this specification shall meet or exceed the standards and specifications indicated in 1.02 above. Whenever a conflict between codes, standards, rules or regulations occurs, the more stringent shall govern.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Allen-Bradley

B. General Electric

C. Square D

2.02 MATERIALS AND EQUIPMENT

General

A. The motor control center shall be constructed to meet or exceed the requirements within NEMA ICS3-322 and UL845, EEMAC and CSA, IEC 439-1 for motor control centers. The motor control center shall be designed, manufactured, and tested in facilities registered to ISO9001 quality standards.

B. Motor control centers shall be suitable for operation on 480 volts, 3 phase, 60 Hertz and connection to an available fault of 42,000 RMS symmetrical amperes, and the incoming line shall enter the top section on the MCC schedule and will be cable connected. Provisions for terminating a neutral wire at

C. The motor control center shall be wired NEMA Class II, Type B.

D. Incoming Line Compartment

AMPI 225 Main circuit breaker shall be top entry. The size and quantity of incoming cables shall be shown on the drawings.

E. Wireways

1. Horizontal wireways of standard sections, both top and bottom, shall be not less than 6" (150 mm) high. To prevent damage to cable insulation, the wireway opening between sections shall have rounded corners and the edges shall be rolled back.
2. A full height vertical wireway and hinged door shall be provided in each standard vertical section. A permanent vertical wireway wall shall separate the units from the vertical wireway, and remain intact even when the units are removed.

E Bus Bars

1. The power bus system shall be supported, braced, and isolated by a bus support molded of a high strength, non-tracking glass-filled polyester material. Bus bracing shall be rated to withstand the fault current listed in Section 1.0 of this specification, but shall not be rated less than 42kA rms symmetrical.
2. The horizontal bus shall be continuously braced within each section. It shall be copper, with tin plating and rated 600A.
3. Both ends of the horizontal bus splices shall have at least two (2) bolts, and each bolt shall be independently capable of handling the load.
4. The vertical bus shall be continuously braced and sandwiched in a glass-filled polyester molding. The bus shall be isolated from the user via a red non-metallic molded cover. The vertical bus shall be copper with the same plating as the horizontal bus, and shall accommodate plug-in loads totaling up to 600A.
5. The horizontal bus shall be connected to the vertical bus with two (2) bolts, and each bolt shall be independently capable of handling the load.
6. A ground bus shall be provided and mounted at the bottom of the motor control center. Ground bus shall be either aluminum or copper and sized according to N.E.C. Code.
7. A full rated neutral bus shall be provided in the motor control center sized per the N.E.C. Code.
8. A grounding stab shall be provided on each plug-in unit, such that the stab engages onto a copper vertical ground bus prior to the power stabs engaging.
9. A grounding point shall be provided at teach started unit for purposes of landing the ground wire coming from the motor. This grounding point shall be directly tied to the horizontal ground bus.

F. Units

1. Unit Mounting

a. After insertion, each plug-in unit shall be held in place by a latch that is located at the front of the unit. Multi-turn latches requiring more than ten (10) turns per latch shall not be acceptable.

b. Plug-in stabs shall be mounted in a polyester molding at the rear of the unit. Wiring from the unit disconnecting means to the plug-in stabs shall be routed into this molding such that the wiring is not be exposed at the rear of the unit.

c. Size 1 through Size 5 non-reversing starters shall be plug-in units.

d. The unit door shall be fastened to the stationary structure (not the unit itself), so that the door can be closed when the unit has been removed. The door shall be hinged on the left-hand side so that it opens away from the vertical wireway.

2. Disconnecting Means

a. Each motor control center unit compartment shall be provided with an individual front door. Starter and feeder tap unit doors shall be interlocked mechanically with the unit disconnect device to prevent unintentional opening of the door while energized and unintentional application of power while the door is open. An interlock between the unit disconnect device and the structure will prevent removal or reinsertion of a unit when the disconnect is in the ON or TRIPPED positions. Means shall be provided for releasing the interlock for international access and application of power. Padlocking arrangements shall permit locking the disconnect device OFF with at least three padlocks with the door closed or open. Means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

b. Circuit breaker type starter units shall have a short circuit rating greater than the available fault current listed in Section 1.0, and shall be motor circuit protectors (MCP) with magnetic only trip. Feeder breakers shall be molded case breakers with thermal magnetic trip and have a short circuit rating greater than the available fault current listed in section 1.0.

3. Unit Control Power

a. Control power shall be 120V and be provided by control power transformers, as required, with one secondary control fuse and two primary fuses. The other secondary lead shall be grounded. Control power transformers shall provide the following excess capacity in addition to that required by the starter coil: size 1 extra 40VA; size 2 - extra 40VA; size 3 - extra 125VA; size 4 - extra 180VA; size 5 - extra 200VA.

b. Control power transformers shall be mounted within the unit.

4. Starters
   a. Motor controllers shall include combination magnetic starters, full voltage starters.
   b. Motor controllers shall be suitable for operation at the voltage and phase indicated on the motor list and be sized for the motor operated.
   c. Motor starters shall be minimum NEMA size 1. Motor starter enclosures shall be sized large enough to accommodate within the enclosure all control devices and terminal strips.
   d. Motor controllers shall have overload protection in each phase leg, and shall be mounted in an enclosure approved for the environmental conditions of the area.
   e. Combination starter doors shall be interlocked mechanically with the unit disconnect device to prevent unintentional opening of the door while energized and unintentional application of power while the door is open. Combination motor controllers and duplex controllers shall employ molded case thermal magnetic circuit breakers. Padlocking arrangements shall permit locking the disconnect device OFF with at least three padlocks with at least three padlocks with the door closed or open.
   f. Combination motor controller and feeder tap units shall employ molded case, thermal magnetic circuit breakers, sized per manufacturer's recommendations to coordinate with the load served and to coordinate with the thermal overload relays.
   g. Each motor magnetic motor starter shall be furnished with two auxiliary contacts.

5. Adjustable frequency drives shall be provided within the motor control center. They shall be factory installed by the motor control center manufacture. Reference adjustable frequency AC drive specifications, Section 16491.

6. Terminal Blocks
   a. Terminal blocks shall be mounted within the unit and located near the front for accessibility. They shall not be located at the rear of the vertical wireway. Power terminal blocks (shall) be provides. On non-plug-in (frame mounted) units, terminal blocks need not be pull-apart style. On plug-in units, control terminal blocks shall be pull-apart style.

7. Nameplates
   a. Each unit door shall have an engraved acrylic nameplate, white with black lettering. a master nameplate shall be provided on each MCC lineup.

8. Control Station
   a. Pilot lights shall be provided and shall be industrial control rated and shall be the Press to Test type. The color code shall be:

COLOR	FUNCTION

RED	Danger, abnormal condition, fault condition
GREEN	Attention, Motor(s) running
WHITE	Normal control, normal pressure of air,
(Clear)	water, lubrication

9. Documentation
   a. Wiring diagrams shall be provided ***(inside each unit)***. The diagram shall show the exact devices inside the unit and shall not be a generic diagram.

G. Finish

Surfaces shall be painted according to the manufacturers standard color scheme. All unpainted parts shall be plated for resistance to corrosion.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All motor controllers and motor control centers shall be securely fastened and mounted in a neat, workmanlike manner.

B. Provide concrete for 4" high concrete pads, along with proper anchor bolts or other devices to be embedded in the concrete using proper templates and instructions as required. Concrete shall be ready-mixed conforming to ASTM C-94, minimum strength shall be 4000 psi at 28 days, maximum slump of 4", maximum water/cement ratio of 0.44. Cement shall be ASTM C150 Type II. Aggregate shall conform to ASTM C33 with maximum size of 3/4". Reinforcement shall be wire fabric conforming to ASTM a-185, size WWF 6 x 6 - W 2.1 x 2.1, unless noted otherwise.

3.02 CLEANING

A. Touch-up scratched or marred surfaces to match original finish.

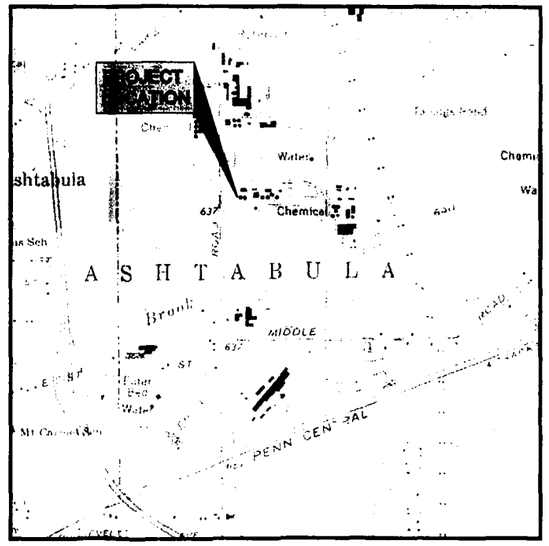
END OF SECTION 16490

PROJECT
DRAWINGS

CONSTRUCTION DESIGN DRAWINGS
FINAL DESIGN SUBMITTAL FOR SOURCE CONTROL
DNAPL RECOVERY SYSTEM

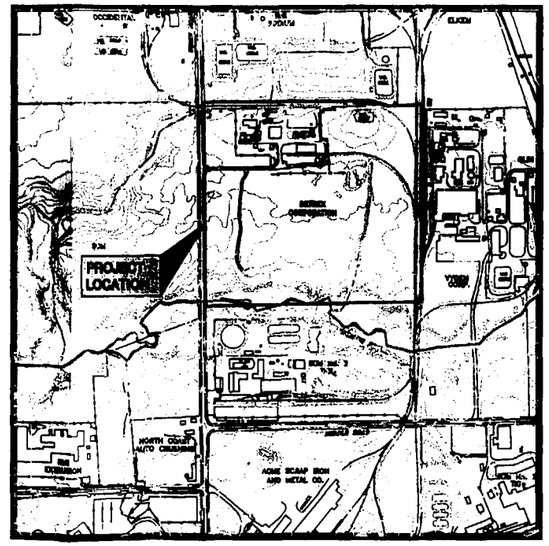
PREPARED FOR
DETREX CORPORATION
APRIL 2001

DRAWING INDEX



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ASHTABULA NORTH & SOUTH, OHIO
1960
PHOTOREVISED 1970

VICINITY MAP



PROJECT AREA

REV	DESCRIPTION OF REVISION	BY	DATE
0	100 PERCENT DESIGN SUBMITTAL	MMS	3/26/01

FINAL DESIGN SUBMITTAL

URS
800 W. St. Clair Ave., Suite 500
Cleveland, Ohio 44113

WARNING
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED	SD
DRAWN	GMZ
CHECKED	DAS
PEER REVIEWED	
PROJECT MANAGER	MLS
DATE	4-10-01

TITLE SHEET

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION	0
PROJECT	38.8E06011.00
DRAWING	C-1
	SHEET 1 OF 16

FUNCTION, PROCESS AND INSTRUMENTATION LEGEND

INSTRUMENT IDENTIFICATION SYMBOLS

	FIRST LETTER	SECOND LETTER	SUCCEEDING LETTER
A	ANALYSIS	ALARM	
B	BURNER FLAME		
C	CONDUCTIVITY	CONTROL	CONTROLLER/CLOSED
D	DENSITY OR SP. GR.	DIFFERENTIAL	
E	VOLTAGE	PRIMARY (ELEMENT)	
F	FLOW	RATIO	
G		GLASS	GAUGE (MEASURE)
H	HAND (MANUAL)		HIGH
I	CURRENT (ELEC.)	INDICATE	
J	POWER	MULTIPOINT	SCAN
K	TIME (TIMER)		
L	LEVEL	LIGHT	LOW OR LOCAL
M	MOISTURE OR HUMIDITY		MIDDLE OR INTERMEDIATE
N	PNEUMATIC	USER'S CHOICE	USER'S CHOICE
O		ORIFICE (RESTRICTION)	OPENED
P	PRESSURE OR VACUUM	POINT (TEST CONNECTION)	
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE	
R	RADIOACTIVITY	RECORD OR PRINT	RECORD
S	SPEED	SWITCH/SAFETY	SWITCH
T	TEMPERATURE		TRANSMIT
U	MULTIVARIABLE	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION	VALVE/DAMPER	VALVE/DAMPER
W	WEIGHT	WELL	
X			RELAY OR SWITCHING
Y		CONVERTER	COMPUTE OR RELAY
Z	POSITION		DRIVE, UNIT

INSTRUMENTATION AND CONTROL

- ANALOG
- DISCRETE
- POWER
- COMPUTER OR PLC DATALINK
- PULSE FREQUENCY
- NON-CONNECTING
- PLC DISCRETE INPUT
- PLC DISCRETE OUTPUT
- PLC ANALOG INPUT
- PLC ANALOG OUTPUT
- SIGNAL SPLIT (IMPLIES RELAY)
- PARALLEL (3 SIGNALS SHOWN)

FUNCTION SYMBOLS

- LOCALLY MOUNTED INSTRUMENT
- INSTRUMENT ACCESSIBLE TO OPERATOR (CONTROLLER OR ON CONTROL PANEL)
- SYSTEM CONTROL PANEL
- INTERLOCK
- PROGRAMMABLE LOGIC CONTROLLER
- TWO INSTRUMENTS IN ONE CASE (LOCALLY OR PANEL MOUNTED)
- INDICATING LIGHT
- TIE-IN POINT
- FLOW DIRECTIONAL ARROW
- TEMPERATURE INDICATOR
- AIR VALVE
- FLOW VALVE
- FLOW TRANSMITTER

PROCESS SYMBOLS

- ON/OFF ARROWS
- GALLONS PER HOUR
- CUBIC FEET PER MINUTE
- POUNDS PER HOUR
- TEMPERATURE
- POUNDS PER SQUARE INCH, GAUGE
- INSULATION (PROCESS (P), HEAT CONSERVATION (HC), PERSONNEL PROTECTION (PP))
- INSULATION (ELECTRIC TRACE (ET), STEAM TRACE (ST))
- REVISION

PIPING AND INSTRUMENT SYMBOLS

THIS DRAWING WAS OBTAINED BY PERMISSION FROM WATER EQUIPMENT SERVICES, INC. (W.E.S., INC.) SOIL VAPOR EXTRACTION SYSTEM LEGEND SHEET, DRAWING NO. G-3.

PIPING SYMBOLS

- CONTROL VALVE W/ POSITIONER
- CONTROL VALVE W/ MANUAL OPERATOR
- PRESSURE REDUCING REGULATOR SELF CONTAINED
- BACK PRESSURE REGULATOR W/ EXTERNAL PRESSURE TAP
- DIFFERENTIAL PRESSURE REDUCING REGULATOR
- UNDEFINED IN-LINE VALVE NORMALLY CLOSED
- UNDEFINED IN-LINE VALVE NORMALLY OPEN
- BUTTERFLY, DAMPER OR LOUVER VALVE
- GLOBE VALVE
- BALL OR OTHER ROTARY VALVE
- PLUG VALVE
- GATE VALVE
- MANUAL OPERATED BALL VALVE
- NEEDLE VALVE
- FLOAT OPERATED VALVE
- SOLENOID VALVE
- MOTOR OPERATED VALVE
- SOLENOID OPERATED VALVE
- ANGLE VALVE
- THREE WAY VALVE
- FOUR WAY VALVE
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE & VACUUM RELIEF VALVE
- CHECK VALVE W/ FLOW DIRECTION INDICATOR
- PIPE W/ STRAINER
- REDUCER
- SAMPLE PORT
- CENTRIFUGAL PUMP
- BLOWER (FAN)
- MOTOR DRIVEN PUMP
- DIAPHRAGM PUMP
- MAGNETIC FLOWMETER
- VORTEX FLOWMETER
- SONIC FLOWMETER
- LIQUID FILTER
- REGULATOR
- FILTER (SOLIDS)
- ROTAMETER W/ INTEGRAL VALVE
- ORIFACE PLATE W/ FLANGES
- PITOT TUBE
- VENTURI
- FLANGE CONNECTION
- PIPE UNION
- END CAP
- QUICK CONNECTOR
- MOISTURE SEPARATOR
- FILTER/SILENCER
- FLEXIBLE HOSE

ELECTRICAL SYMBOL LEGEND

SCHEMATIC SYMBOLS

- CONTACT - NORMALLY OPEN WITH NEMA SIZE INDICATED OR COIL IDENTIFICATION AS APPLICABLE.
- CONTACT - NORMALLY CLOSED WITH NEMA SIZE INDICATED OR COIL IDENTIFICATION AS APPLICABLE.
- OVERLOAD RELAY HEATER.
- MAGNETIC STARTER WITH NEMA SIZE INDICATED.
- CIRCUIT BREAKER, MAGNETIC, TRIP SHOWN.
- CIRCUIT BREAKER, THERMAL MAGNETIC, TRIP SHOWN.
- CIRCUIT INTERRUPTER, 3 POLE
- DISCONNECT, 3 POLE
- CIRCUIT BREAKER WITH CURRENT LIMITING FUSES, TRIP AND FUSE RATING INDICATED.
- FUSED SWITCH, SWITCH AND FUSE CURRENT RATING INDICATED.
- SWITCH - CURRENT RATING INDICATED.
- DRAWOUT CIRCUIT BREAKER, LOW VOLTAGE
- DRAWOUT CIRCUIT BREAKER, MEDIUM VOLTAGE
- DRAWOUT FUSED SWITCH, MEDIUM VOLTAGE
- LIGHTING ARRESTER
- FUSE
- CAPACITOR
- METER WITH SWITCH - SCALE RANGE SHOWN
- GROUND
- MAGNETIC COIL
- TRANSFORMER, VOLTAGES, PHASE AND RATING INDICATED AS APPLICABLE.
- GROUND FAULT RELAY WITH C.T.
- REMOTE DEVICE
- SELECTOR SWITCH: MAINTAINED CONTACT WITH CONTACT POSITION INDICATED. CHART IDENTIFIES OPERATION.

CKT.	MARK	POSITION OFF	POSITION AUTO
1	X	0	0
2	0	0	X

X - CLOSED CONTACT
0 - OPEN CONTACT

- CURRENT TRANSFORMER, NUMBER AND RATIO INDICATED
- INDICATING LIGHT - LETTER INDICATES COLOR
  A - AMBER G - GREEN
  B - BLUE R - RED
  C - CLEAR W - WHITE
- PUSH TO TEST INDICATING LIGHT
- PROTECTIVE RELAY
  XX = 47 PHASE FAILURE/PHASE REVERSE
  50 INSTANTANEOUS
  51 TIME OVERCURRENT
  51GS GROUND FAULT/GROUND SENSOR
- MOTOR, 3 PHASE, WITH HP RATING
- LIMIT SWITCH, SPRING RETURN, NORMALLY OPEN.
- LIMIT SWITCH, SPRING RETURN, NORMALLY CLOSED.
- LIMIT SWITCH, SPRING RETURN, HELD OPEN.
- LIMIT SWITCH, SPRING RETURN, HELD CLOSED.
- LIMIT SWITCH, SPRING RETURN, NEUTRAL POSITION.
- LIMIT SWITCH, MAINTAINED.
- CONDUCTORS, NOT CONNECTED
- CONDUCTORS, CONNECTED
- PUSH-BUTTON SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- PUSH-BUTTON SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- PUSH-BUTTON SWITCH, DOUBLE CIRCUIT
- PUSH-BUTTON SWITCH, DOUBLE CIRCUIT WITH MUSHROOM HEAD
- PUSH-BUTTON SWITCH, MAINTAINED CONTACTS WITH MECHANICAL INTERLOCK.
- LIQUID LEVEL SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- LIQUID LEVEL SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- VACUUM/PRESSURE SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- VACUUM/PRESSURE SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- TEMPERATURE ACTIVATED SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- TEMPERATURE ACTIVATED SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- FLOW (AIR, WATER, ETC.) SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- FLOW (AIR, WATER, ETC.) SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- FOOT SWITCH, MOMENTARY CONTACT, NORMALLY OPEN.
- FOOT SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED.
- TIME DELAY CONTACT, TIME CLOSED, NORMALLY OPEN.
- TIME DELAY CONTACT, TIME CLOSED, NORMALLY CLOSED.
- TIME DELAY CONTACT, TIME OPEN, NORMALLY OPEN.
- TIME DELAY CONTACT, TIME OPEN, NORMALLY CLOSED.

LIST OF ACRONYMS

CR	CONTROL RELAY
DNAPL	DENSE, NON-AQUEOUS PHASE LIQUID
HDPE	HIGH DENSITY POLYETHYLENE
LSA	LEVEL SWITCH ALARM
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
PLC	PROGRAMMABLE LOGIC CONTROLLER
RW	RECOVERY WELL
SVE	SOIL VAPOR EXTRACTION
VGAC	VAPOR PHASE GRANULAR ACTIVATED CARBON

REV	DESCRIPTION OF REVISION	BY	DATE
0	100 PERCENT DESIGN SUBMITTAL	MMS	3/28/01

FINAL DESIGN SUBMITTAL

URS
800 W. St. Clair Ave., Suite 500
Cleveland, Ohio 44113

WARNING
0 1/2 1
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DRAWN	
CHECKED	DAS
PEER REVIEWED	
PROJECT MANAGER	MLS
DATE	4-10-01

PIPING AND INSTRUMENT LEGEND SHEET

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING C-2
SHEET 2 OF 16

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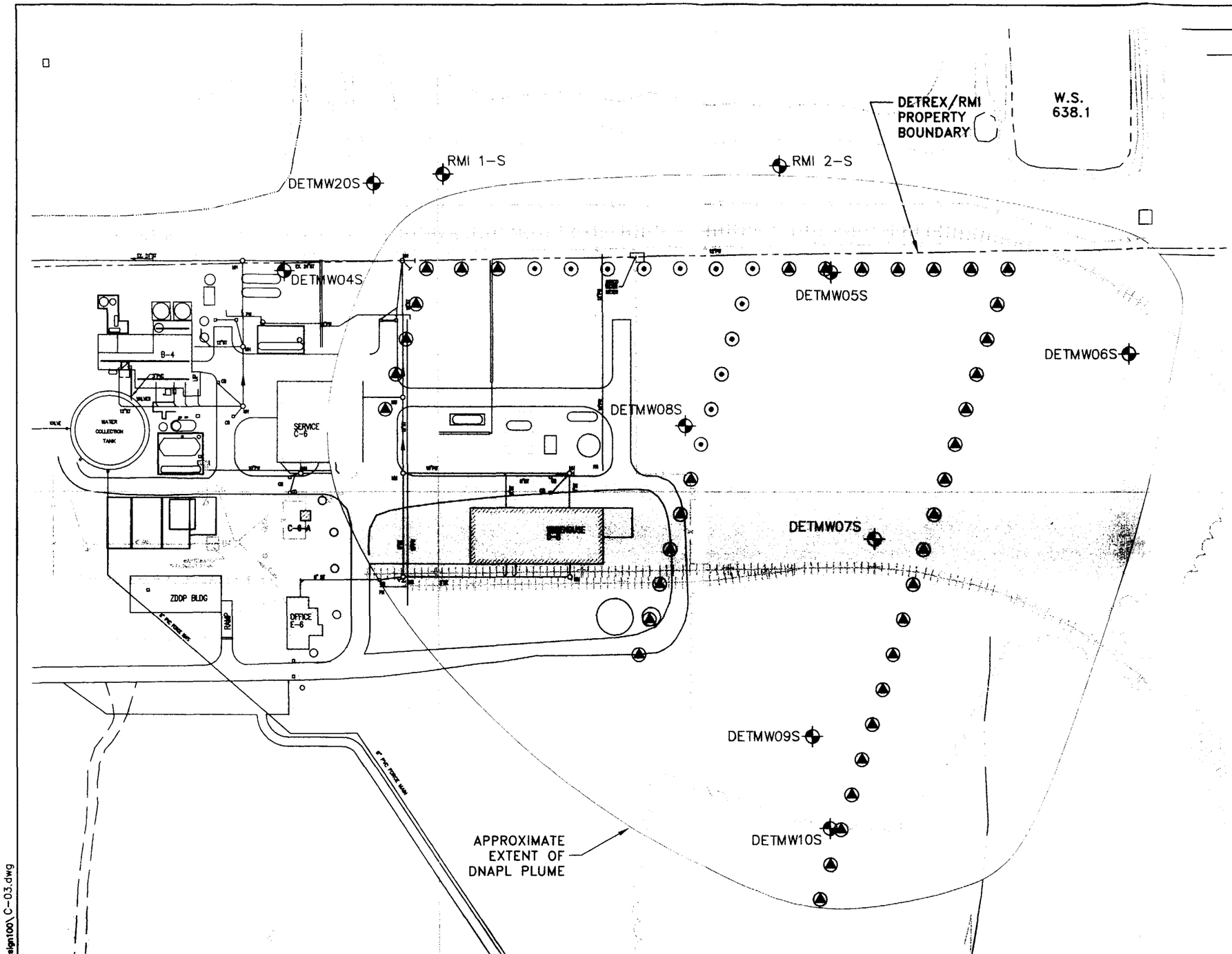

LEGEND

- PROPERTY/PARCEL LINE
- W.S. 638.1 — APPROXIMATE ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- DETMW08S — MONITORING WELL
- (12) PROPOSED PHASE I DNAPL EXTRACTION WELLS
- (38) POTENTIAL PHASE II DNAPL EXTRACTION WELLS
- APPROXIMATE EXTENT OF DNAPL

NOTES:

1. THE CONSTRUCTION DOCUMENTS INCLUDE THESE PLAN DRAWINGS PLANS AND THE ACCOMPANYING PROJECT BOOKLET SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE TO MEET THE COMPLETE PROJECT REQUIREMENTS AS IDENTIFIED IN THE CONSTRUCTION DOCUMENTS AND TO REPORT ANY CONFLICTING REQUIREMENTS BETWEEN THE PLANS AND BOOKLET SPECIFICATIONS DIRECTLY TO THE OWNER'S REP. FINAL INTERPRETATION OF THE PROJECT REQUIREMENTS LIES WITH THE OWNER'S REP.
2. EXISTING SITE INFORMATION SHOWN ON THESE DRAWING IS TAKEN FROM A SURVEY BY BURGESS & NIPLE – DETREX CORPORATION – ASHTABULA, OHIO PLANT COLLECTION & TREATMENT IMPROVEMENTS SHEET 1 OF 21 DATED AUGUST 1989 AND SURVEY BY MIDDOUGH & ASSOCIATES – ASHTABULA PLANT ADDITION SITE PLAN DRAWING NO. C1 DATED MARCH 26, 1996. THIS INFORMATION HAS BEEN PRESUMED TO BE AN ACCURATE REPRESENTATION OF THE CONDITIONS AT THE SITE. WORK PERFORMED AT THE SITE OR IN THE ADJACENT WORK AREAS SINCE THE DATE OF THE SURVEY MAY NOT BE SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AT THE SITE AND REPORT SIGNIFICANT DIFFERENCES TO THE OWNER'S REP. AND THE OWNER'S REPRESENTATIVE IMMEDIATELY.
3. THE CONTRACTOR SHALL CAUSE NOTICE TO BE GIVEN TO THE OHIO UTILITY PROTECTION SERVICE (800-362-2764) AT LEAST 72 HOURS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING ALL NECESSARY PERMITS FOR WORK.
5. THE CONTRACTOR SHALL CONFINE HIS ACTIVITIES TO WITHIN THE WORK AREAS. THE CONTRACTOR SHALL NOT TRESPASS UPON ADJACENT PROPERTIES OR RIGHTS OF WAY WITHOUT THE WRITTEN CONSENT OF THE PROPERTY OWNER.
6. DNAPL – DENSE, NON-AQUEOUS PHASE LIQUID

DEMOLITION NOTES:

1. ALL REMOVED ITEMS SUCH AS, BUT NOT LIMITED TO POSTS, LIGHTING, AND FENCING SHALL REMAIN THE PROPERTY OF DETREX CORP. ITEMS SHALL BE STOCKPILED IN A SECURED AREA AS DIRECTED BY THE OWNER.
2. THE CONTRACTOR SHALL LEGALLY DISPOSE OF ANY SURPLUS EXCAVATED MATERIAL OR CONSTRUCTION DEBRIS, OFF OF OWNERS PROPERTY.

N

0 25 50 100

APPROXIMATE SCALE IN FEET

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DATE 4-10-01

SITE PLAN WITH AREA OF DNAPL PLUME IDENTIFIED

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.6E06011.00
DRAWING C-3
SHEET 3 OF 14

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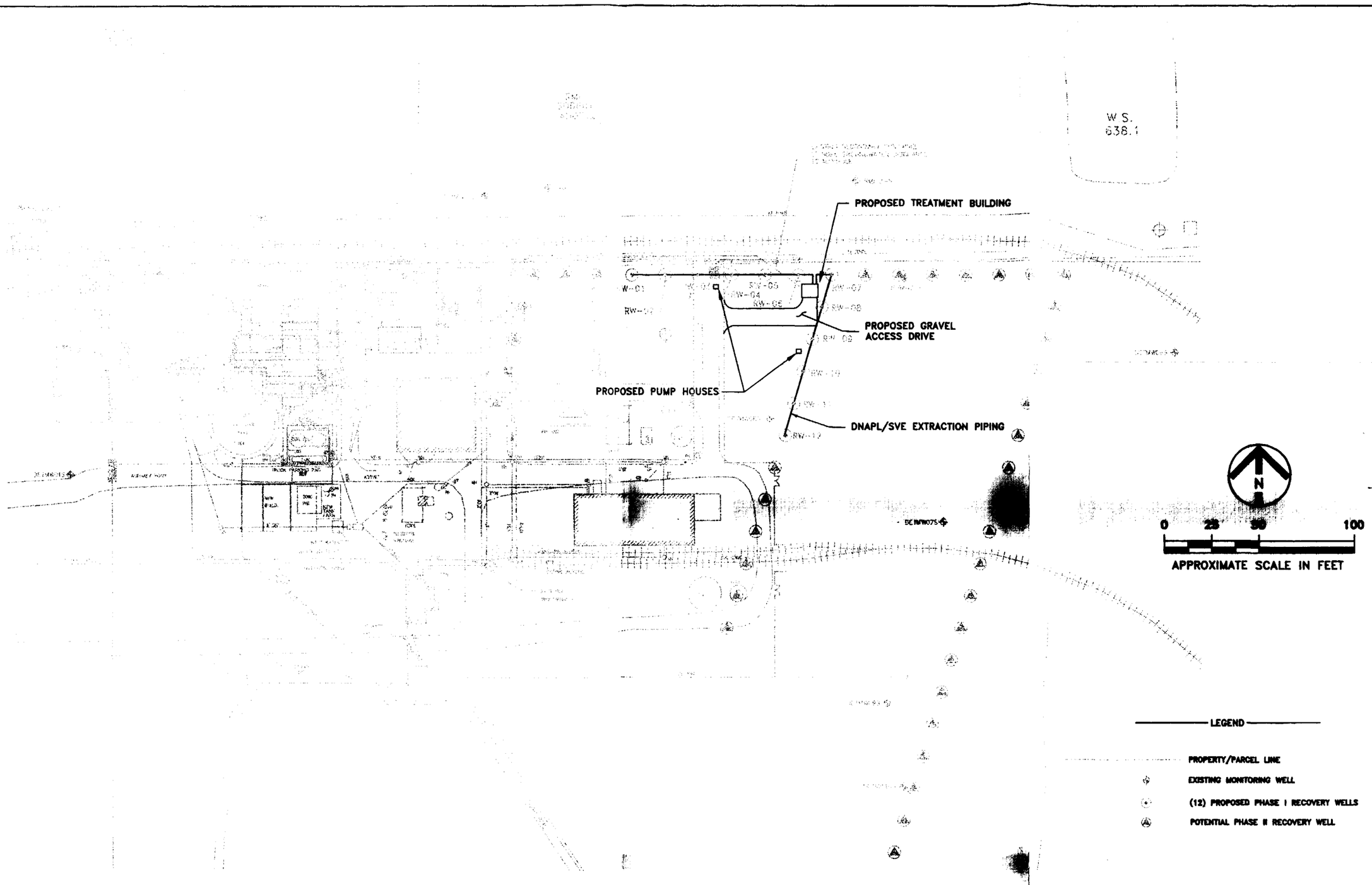

REV	DESCRIPTION OF REVISION	BY	DATE
1	100 PERCENT DESIGN SUBMITTAL	MMS	3/26/01

FINAL DESIGN SUBMITTAL

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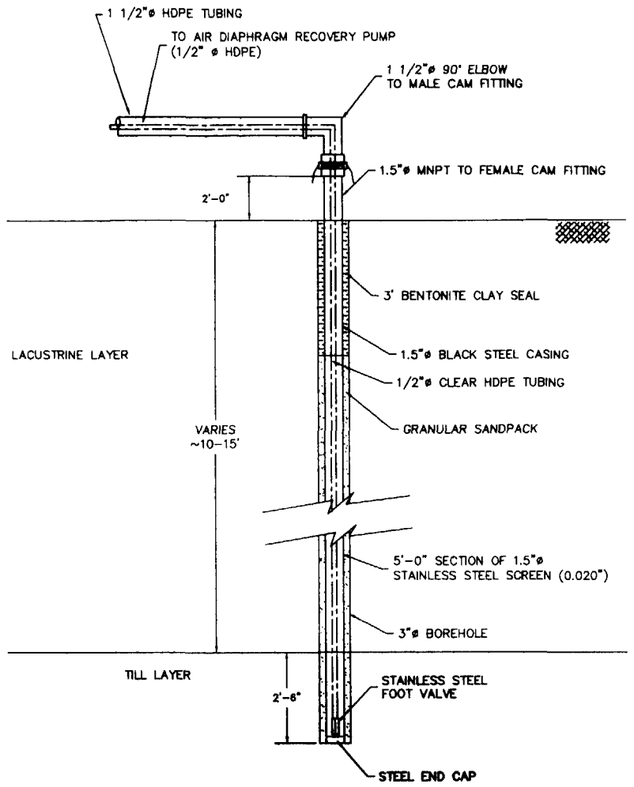
DATE 4-16-01

DNAPL RECOVERY SYSTEM PLAN
SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

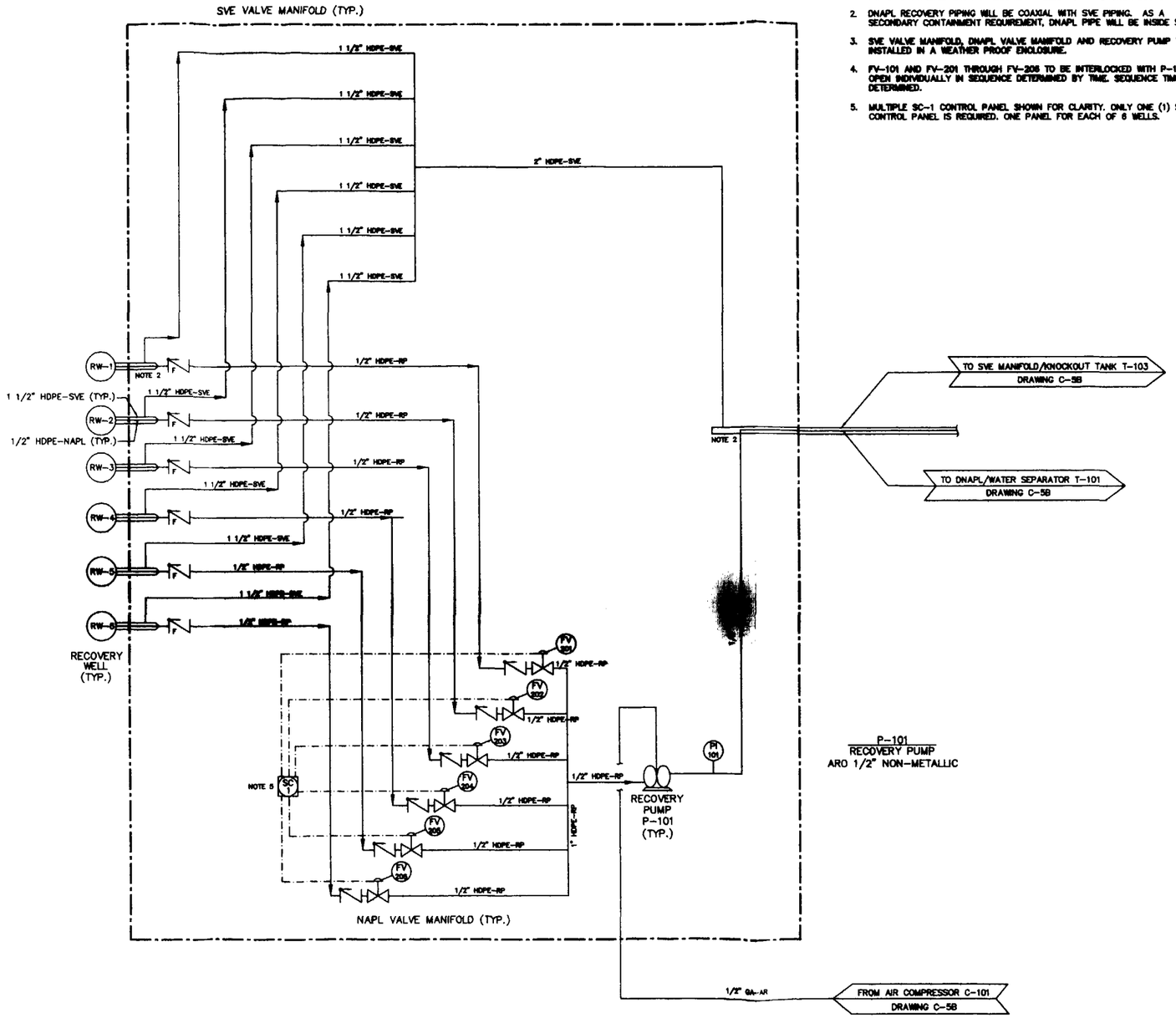
REVISION 0
PROJECT 38.SE09011.00
DRAWING C-4
SHEET 4 OF 16



TYPICAL RECOVERY WELL DETAIL PER SECTION 02676

NOT TO SCALE

INSTRUMENT IDENTIFICATION LETTERS				
	FIRST LETTER		SUCCEEDING LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION MODIFIER
A			ALARM	
C				CONTROL
E			SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE			
H	HAND			HIGH
I			INDICATOR	
K	TIME			
L	LEVEL			LOW
M		MONITOR		
P	PRESSURE			
Q		TOTALIZE		
R			RECORD	
S	SYSTEM		SWITCH	
T	TEMPATURE			SENSOR/ TRANSMITTER
V	SLUDGE			VALVE
Y	EVENT, STATE, OR PRESENCE			



NOTES:

1. RECOVERY WELLS RW-7 THROUGH RW-12 ARE NOT SHOWN. RW-1 THROUGH RW-6 IS TYPICAL. EACH 6 RECOVERY WELLS TO HAVE ONE RECOVERY PUMP.
2. DNAPL RECOVERY PIPING WILL BE COAXIAL WITH SVE PIPING. AS A SECONDARY CONTAINMENT REQUIREMENT, DNAPL PIPE WILL BE INSIDE SVE PIPE.
3. SVE VALVE MANIFOLD, DNAPL VALVE MANIFOLD AND RECOVERY PUMP TO BE INSTALLED IN A WEATHER PROOF ENCLOSURE.
4. FV-101 AND FV-201 THROUGH FV-206 TO BE INTERLOCKED WITH P-101 TO OPEN INDIVIDUALLY IN SEQUENCE DETERMINED BY TIME. SEQUENCE TIME TO BE DETERMINED.
5. MULTIPLE SC-1 CONTROL PANEL SHOWN FOR CLARITY. ONLY ONE (1) SC-1 CONTROL PANEL IS REQUIRED. ONE PANEL FOR EACH OF 6 WELLS.

REV	DESCRIPTION OF REVISION	BY	DATE
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FINAL DESIGN SUBMITTAL

URS
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PROJECT MANAGER MLS
DATE 4-10-01

PIPING & INSTRUMENT DIAGRAM - FIELD EQUIPMENT

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING C-5A
SHEET 5 OF 16

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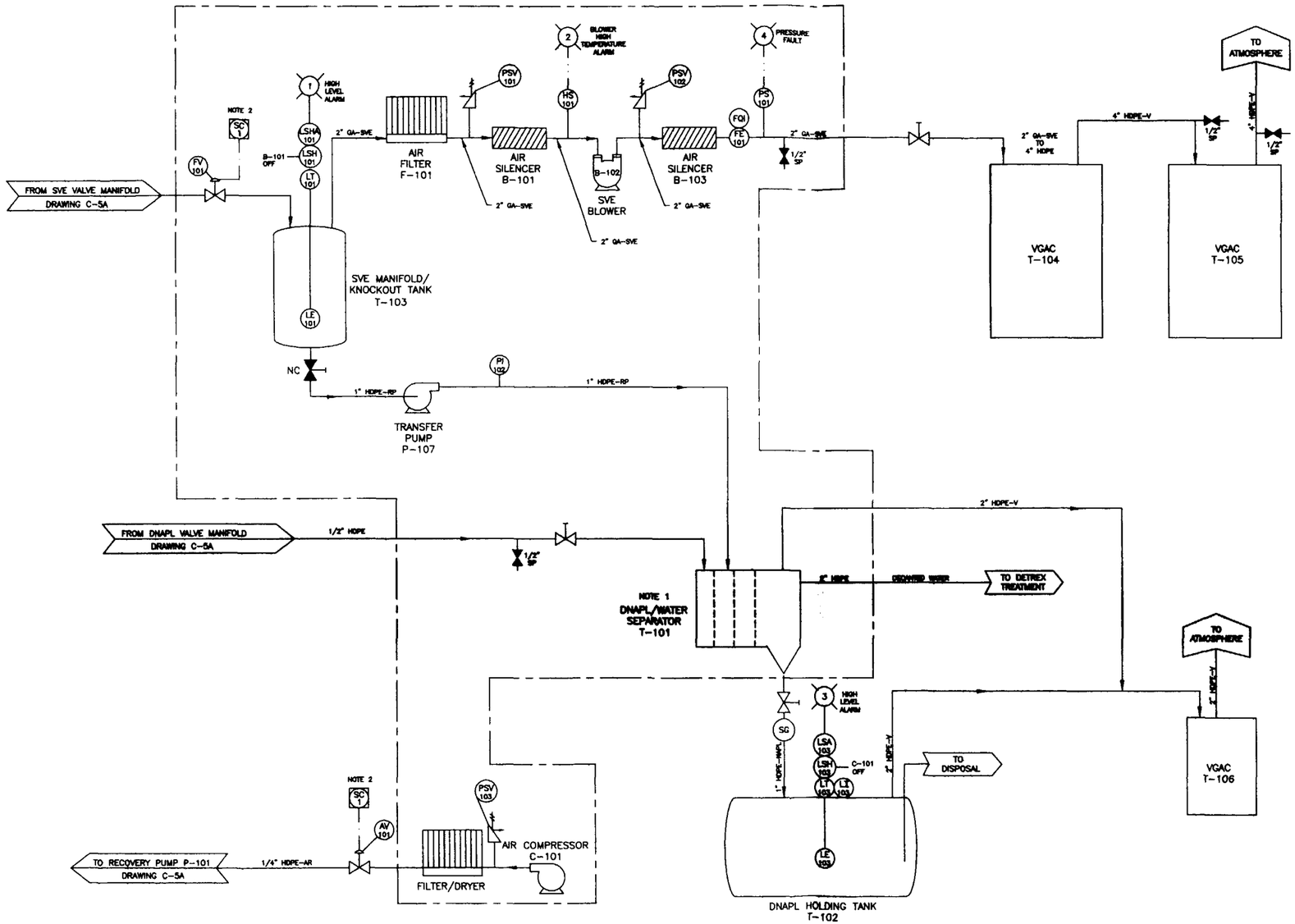

NOTES:

1. DNAPL/WATER SEPARATOR, T-101, WILL BE ELEVATED TO PROVIDE GRAVITY FEED TO DNAPL/WATER HOLDING TANK, T-102.
2. MULTIPLE SC-1 CONTROL PANEL SHOWN FOR CLARITY. ONLY ONE (1) SC-1 CONTROL PANEL IS REQUIRED. ONE PANEL FOR EACH OF 6 WELLS.

T-101
DNAPL/WATER SEPARATOR
15 GPM

T-102
DNAPL HOLDING TANK
1,500-GALLON

T-103
SVE KNOCKOUT TANK
40-GALLON

T-104/T-105
(2) VAPOR PHASE
GRANULAR ACTIVATED CARBON (GAC)
CARBON CAPACITY 1,000 LBS

T-106
VAPOR PHASE
GRANULAR ACTIVATED CARBON (GAC)
CARBON CAPACITY 200 LBS

C-101
AIR COMPRESSOR
100 SCFM @ 50 PSIG

B-102
SVE BLOWER
100 SCFM @ 4" HG

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION MODIFIER
A			ALARM	
B	BLOWER			CONTROL
C	COMPRESSION			CONTROL
E			SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE			
H	HEAT			HIGH
I			INDICATOR	
L	LEVEL			LOW
M		MONITOR		
P	PRESSURE			
Q		TOTALIZE		
R			RECORD	
S	SYSTEM		SWITCH	
T	TANK			SENSOR/ TRANSMITTER
V	VAPOR			VALVE
Y	[illegible]			

REV	DESCRIPTION OF REVISION	BY	DATE
0	100 PERCENT DESIGN SUBMITTAL	MMS	3/28/01

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PIPING & INSTRUMENT DIAGRAM - EQUIPMENT BUILDING

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING C-5B
SHEET 6 OF 16

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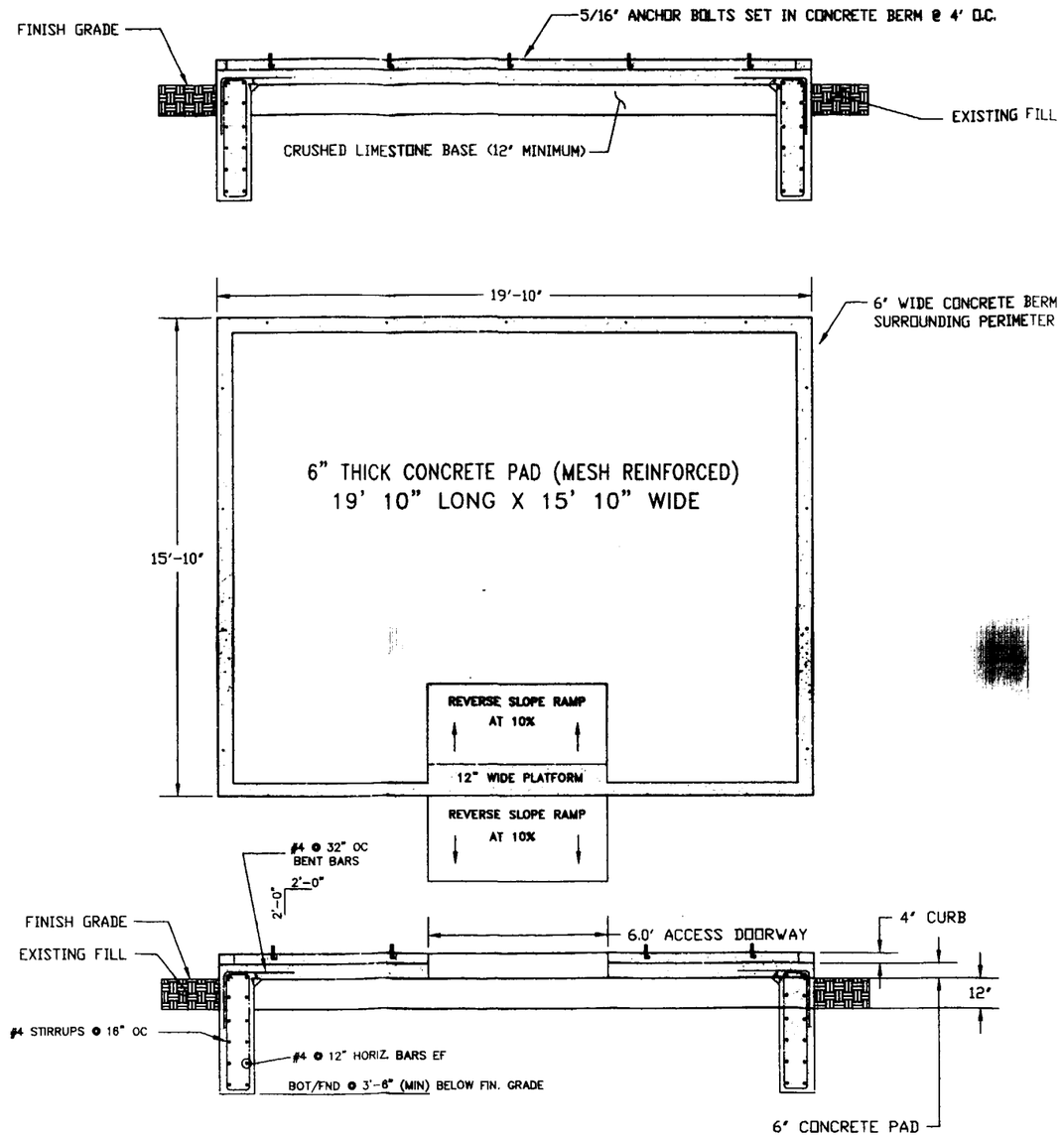

Note:

RAMP OUTSIDE BUILDING SHALL HAVE 10" COMPACTED, CRUSHED LIMESTONE BASE, WIRE MESH REINFORCEMENT AND MINIMUM 4 INCH THICKNESS.

N

0 25 50 100

APPROXIMATE SCALE IN FEET

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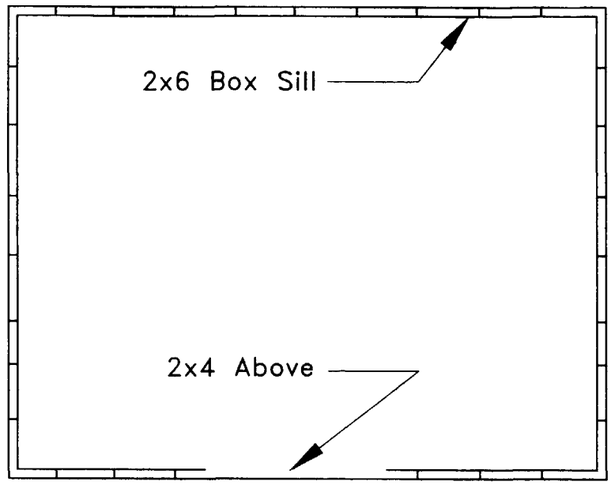
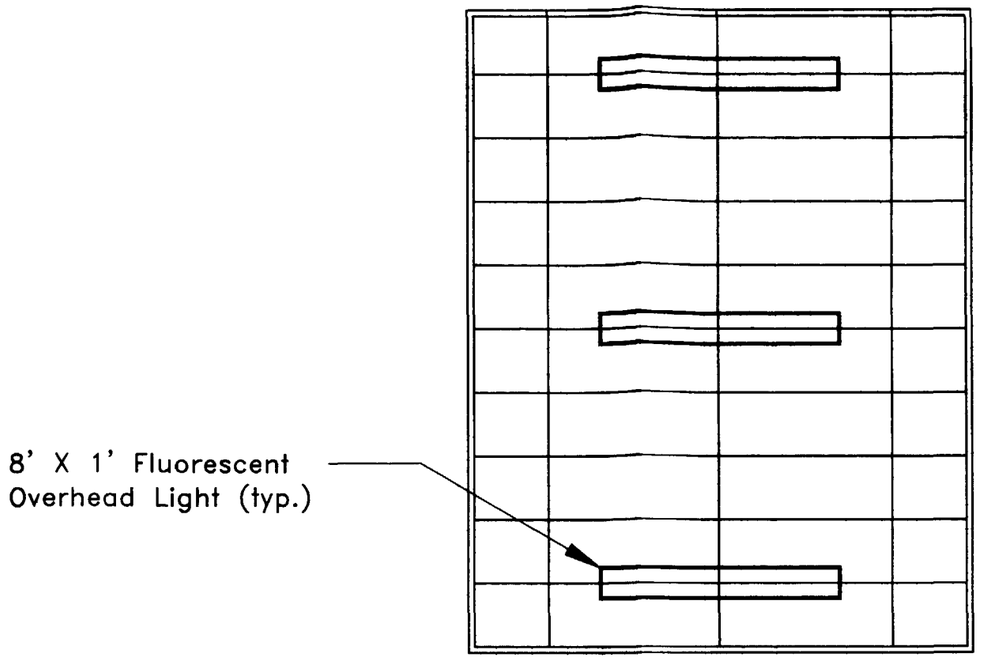
BUILDING PAD PLAN AND PROFILE

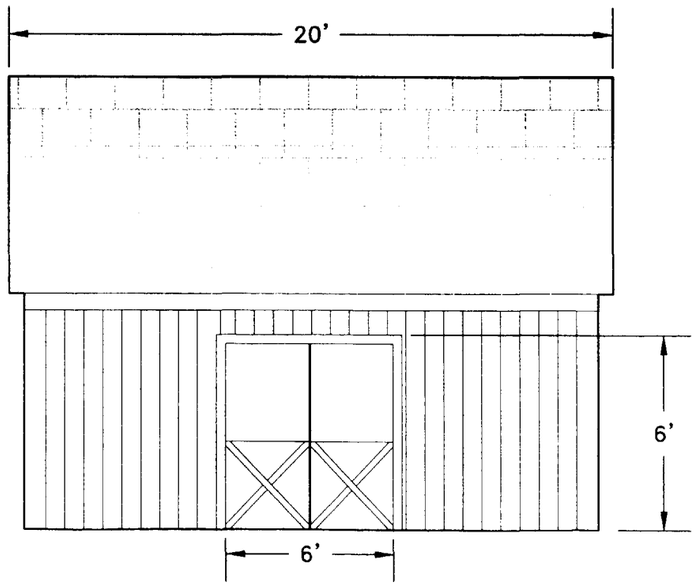
SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

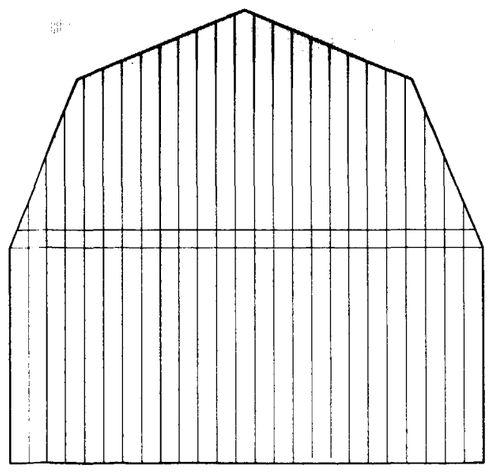
REVISION 0
PROJECT 36.8E06011.00
DRAWING C-6
SHEET 7 OF 16



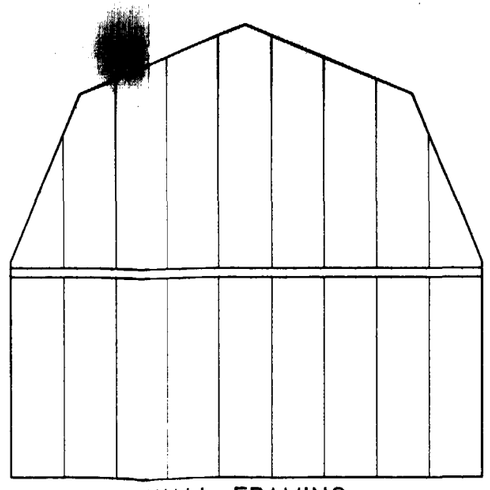


ROOF FRAMING





EXTERIOR PANELING



WALL FRAMING

0 2.5 5 7.5

APPROXIMATE SCALE IN FEET

NOTES:

Building shall be 16' x 20' x 7' Sidewall Deluxe Estate Yard Barn by Heartland Industries or approved equal.

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FINAL DESIGN SUBMITTAL

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PROPOSED TREATMENT BUILDING

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING C-7
SHEET 8 OF 16

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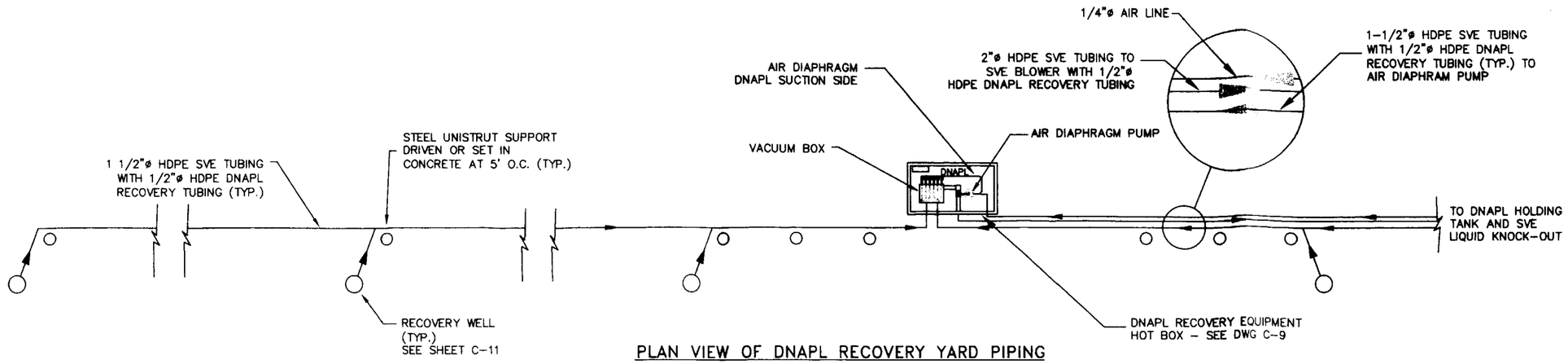
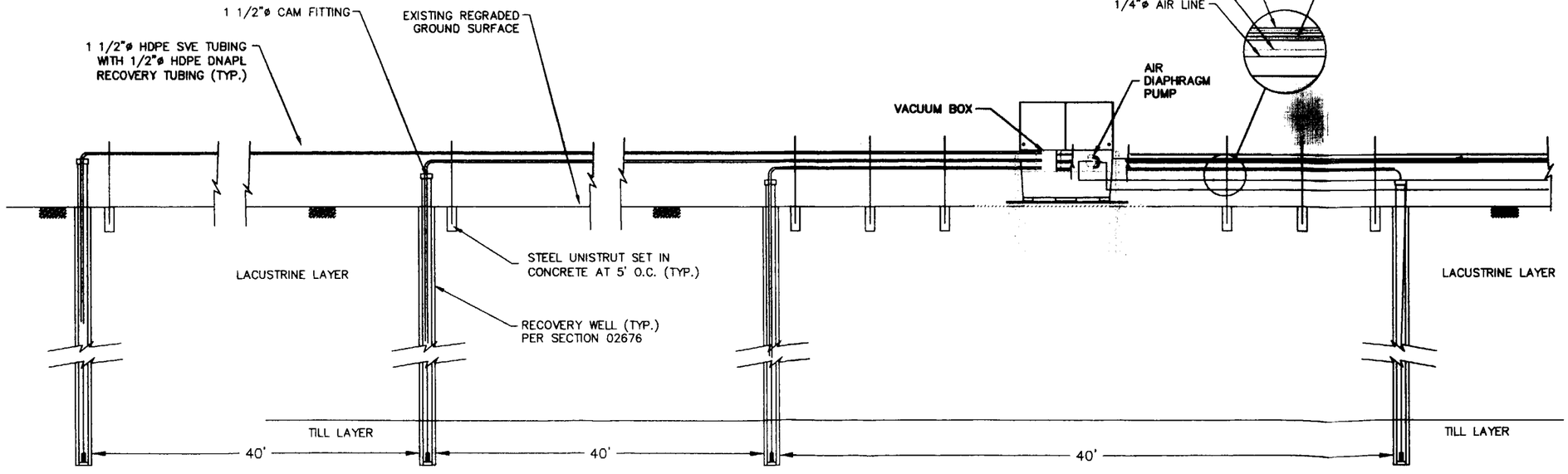


PLAN VIEW OF DNAPL RECOVERY YARD PIPING



PROFILE VIEW OF DNAPL RECOVERY YARD PIPING

NOTE:

PLAN & PROFILE DRAWING IS TYPICAL FOR 1 (ONE) DNAPL RECOVERY SYSTEM LEG. ONE LEG CONSISTS OF 6 (SIX) RECOVERY WELLS.

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PROJECT MANAGER	MLS
DATE	4-10-01

DNAPL RECOVERY YARD PIPING PLAN & PROFILE

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING C-8
SHEET 9 OF 16

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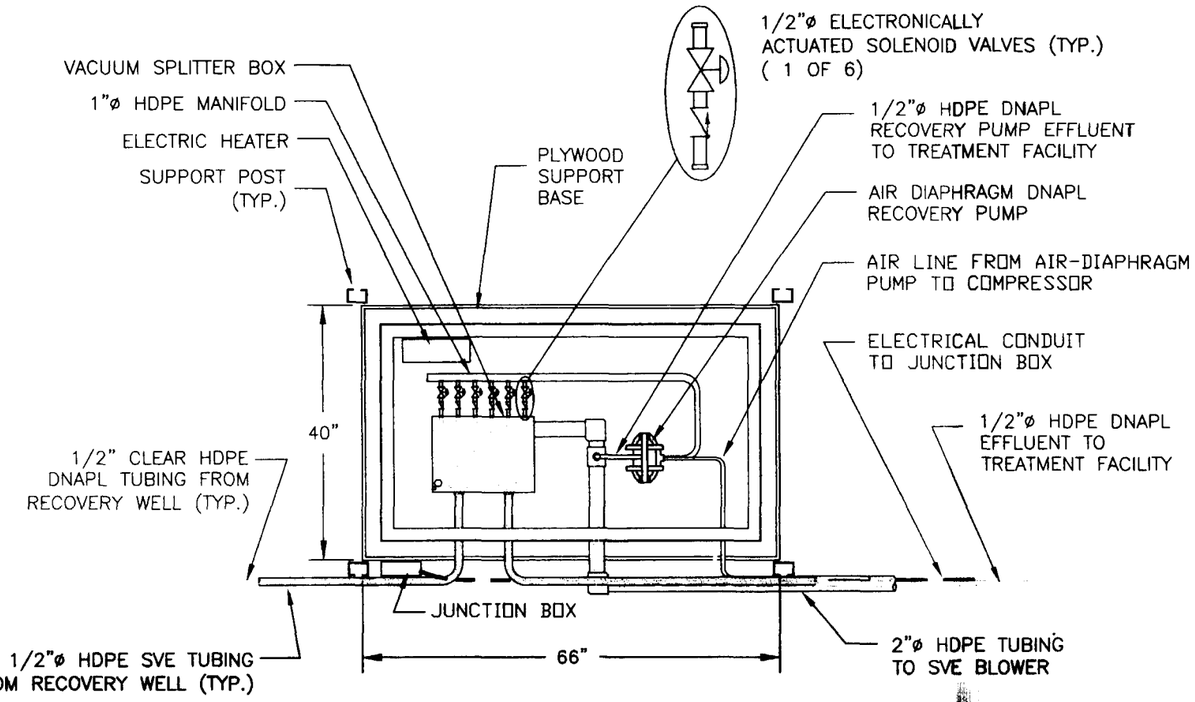
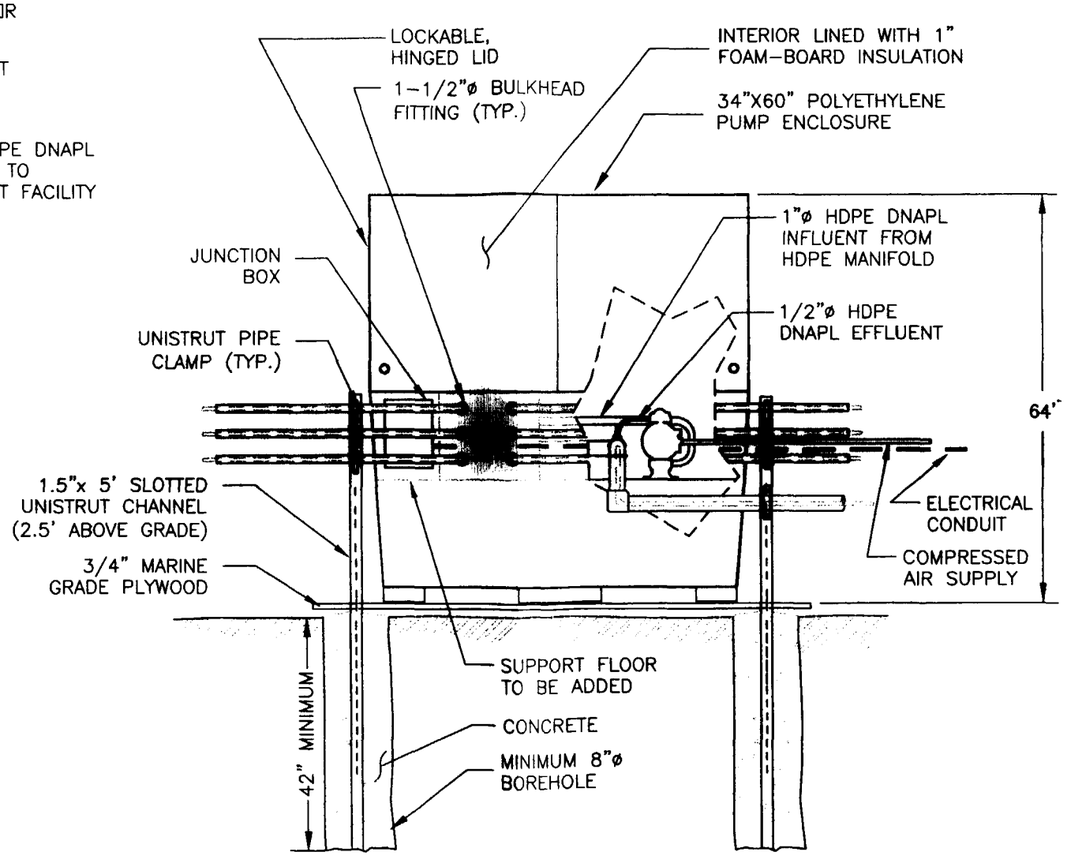


SATELLITE PUMP ENCLOSURE – PLAN VIEW

Scale: 1/2" = 1' (approx.)



SATELLITE PUMP ENCLOSURE – PROFILE VIEW

Scale: 1/2" = 1' (approx.)

NOTES:

1. PUMP ENCLOSURE WILL BE THE PRE-MANUFACTURED EAGLE TWO DRUM SECONDARY CONTAINMENT WORKSATION UNIT FROM LAB SAFETY EQUIPMENT, CO. MODEL OA-47406 OR APPROVED EQUAL.
2. DNAPL RECOVERY PUMP INFLUENT AND EFFLUENT FITTINGS CAN BE ROTATED 180° TO FACILITATE INSTALLATION.

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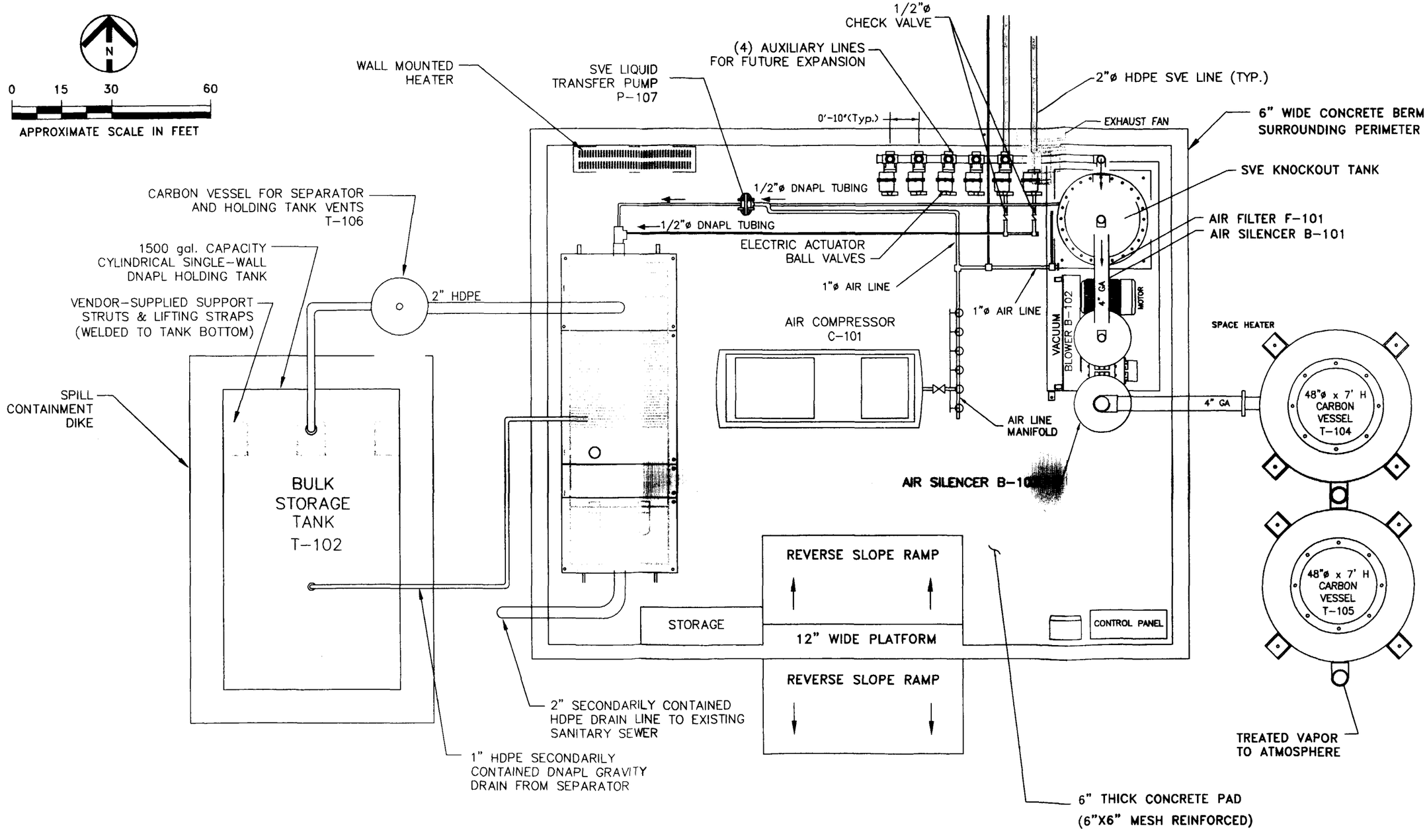
PROJECT MANAGER	MLS
DATE	4-10-01

DNAPL RECOVERY SYSTEM
OUTDOOR PUMP ENCLOSURE
SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION	0
PROJECT	36.E08011.00
DRAWING	C-9
SHEET	10 OF 16



REV	DESCRIPTION OF REVISION	BY	DATE
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FINAL DESIGN SUBMITTAL

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DATE 4-10-01

TREATMENT BUILDING EQUIPMENT LAYOUT

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E08011.00
DRAWING C-10
SHEET 11 OF 16

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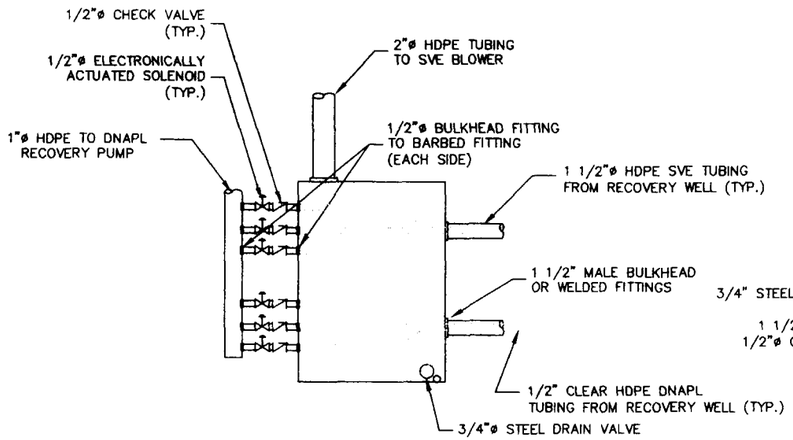
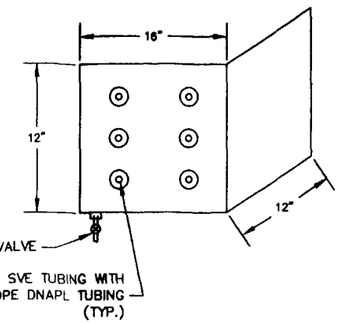


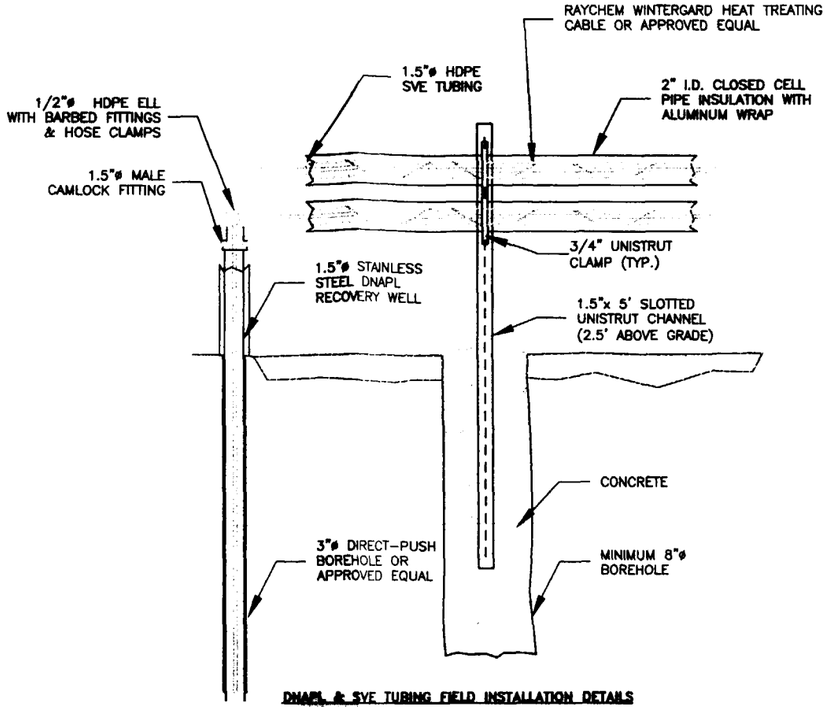
SVE VACUUM BOX - PLAN VIEW

NOT TO SCALE



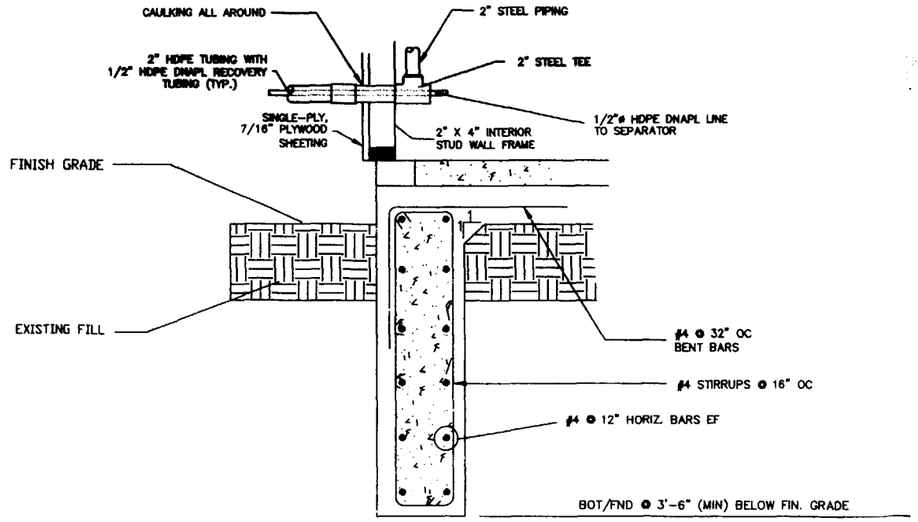
SVE VACUUM BOX - PROFILE VIEW

NOT TO SCALE



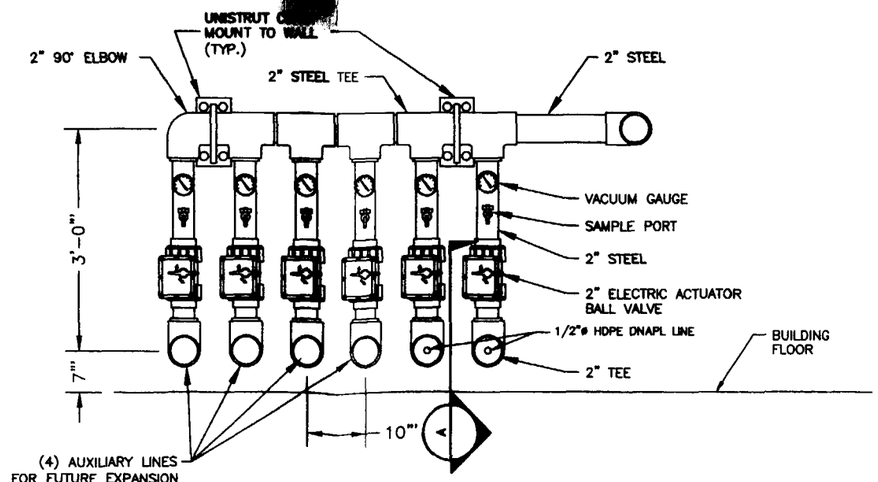
DNAPL & SVE TUBING FIELD INSTALLATION DETAILS

NOT TO SCALE



TYPICAL WALL PENETRATION DETAIL - SECTION A

NOT TO SCALE



SOIL VAPOR EXTRACTION MANIFOLD DETAIL

NOT TO SCALE

REV	DESCRIPTION OF REVISION	BY	DATE
1	100 PERCENT DESIGN SUBMITTAL	MMS	3/28/01

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WARNING
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PEER REVIEWED	
PROJECT MANAGER	MLS
DATE	4-10-01

DNAPL RECOVERY SYSTEM DETAILS

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION	0
PROJECT	38.8E06011.00
DRAWING	C-11
SHEET	12 OF 16

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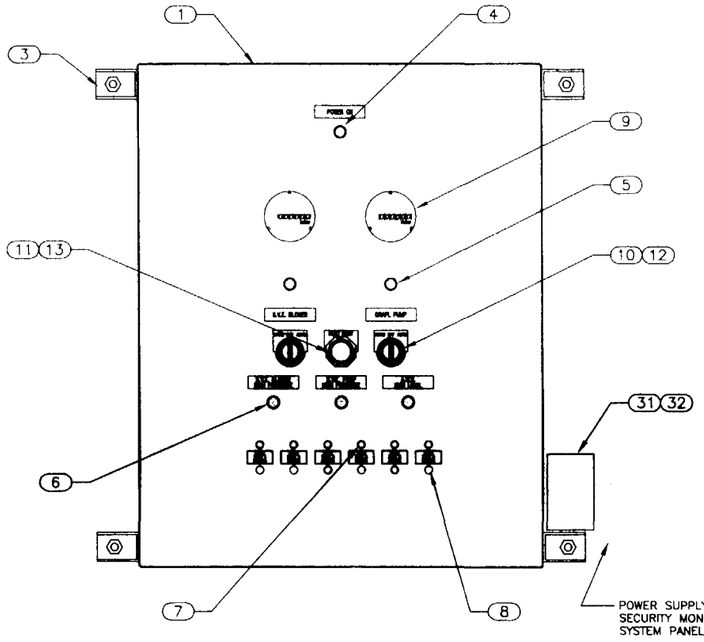

REMEDIATION SYSTEM PANEL EXTERIOR LAYOUT

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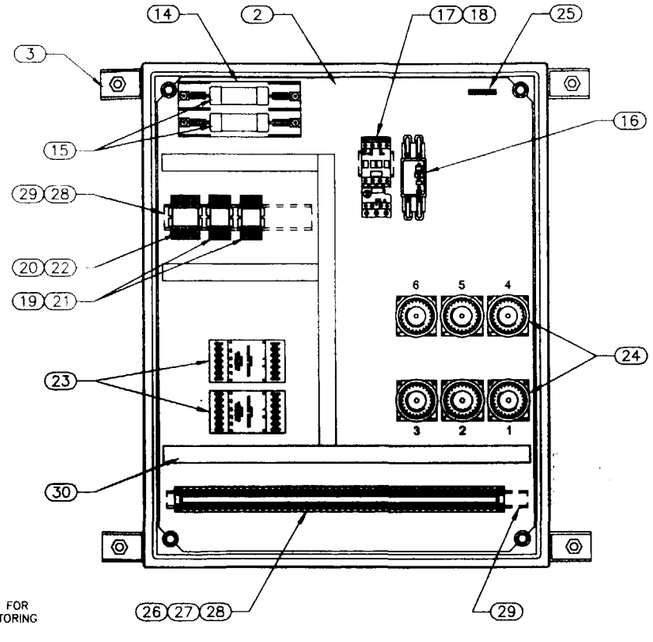

REMEDIATION SYSTEM PANEL INTERIOR LAYOUT

NOT TO SCALE

BILL OF MATERIALS

NO.	QTY.	PART DESCRIPTION	MANUFACTURER	CAT. NO.	NO.	QTY.	PART DESCRIPTION	MANUFACTURER	CAT. NO.
1	1	30x24x8 NEMA 12 STEEL ENCLOSURE	HOFFMAN	C-SD30248	17	1	CONTACTOR 24VAC, 1 PHASE, 2 HP	SQUARE D	LC1D121006
2	1	SUB-PANEL - CARBON STEEL	HOFFMAN	C-P3024	18	1	OVERLOAD RELAY 6A - 13A, 2HP	SQUARE D	LR2D1316
3	4	MOUNTING FEET	HOFFMAN	C-MFK	19	2	CONTROL RELAY, 3 POLE, 120VAC COIL	SQUARE D	8501-RS43V20
4	1	LAMP BASE W/CLEAR LENS & 24V BULB	SQUARE D	9001 OC 24	20	1	CONTROL RELAY, 4 POLE, 120VAC COIL	SQUARE D	8501-RS44V20
5	2	LAMP BASE W/AMBER LENS & 24V BULB	SQUARE D	9001 OA 24	21	2	RELAY BASE, 3 POLE	SQUARE D	8501-NR43
6	3	LAMP BASE W/RED LENS & 24V BULB	SQUARE D	9001 OR 24	22	1	RELAY BASE, 4 POLE	SQUARE D	8501-NR44
7	6	PILOT LIGHT W/RED LENS, 125V, 1/3W	LITTELFUSE	13 ?	23	2	INTRINSICALLY SAFE RELAY MODULE	WARRICK	27A1E0
8	6	PILOT LIGHT W/GREEN LENS, 125V, 1/3W	LITTELFUSE	13 ?					
9	2	HOUR METER, 24V, 5 DIGIT	REDINGTON	710-0002	25	1	GROUND BAR	SQUARE D	PK9-GTA
10	2	SWITCH, 3 POSITION, NEMA 4, H-O-A	SQUARE D	9001 KS43BH13	26	50	TERMINAL BLOCK, 300V	SQUARE D	9080 GR6
11	1	PUSHBUTTON SWITCH, NEMA 4, RESET	SQUARE D	9001 ? ? ?	27	6	END BARRIER	SQUARE D	9080 GM68
12	2	HAND-OFF-AUTO PLATE	FURNAS	52HL-37	28	6	END CLAMP	SQUARE D	9080 MHA10
13	1	FAULT RESET PLATE	FURNAS	52HL-??	29	30	DIN RAIL (QTY. IN INCHES)	SQUARE D	43
14	1	FUSE HOLDER, 2 POLE	SQUARE D	-	30	58	WIRE CHANNEL (QTY. IN INCHES)	PANDUIT	1x3 WHITE
15	2	FUSE, 90 AMP, 250V (FUSETRON)	BUSSMANN	FRN-R-90	31	1	BELL BOX W/ WEATHERTIGHT COVER	BELL	5320-0
16	1	CIRCUIT BREAKER, 2 POLE, 20 AMP	SQUARE D	QOU-220	32	1	DUPLEX RECEPTACLE	LEVITON	5262-I

GENERAL ELECTRICAL NOTES:

1. ALL ELECTRICAL EQUIPMENT AND WIRING SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF NEC ARTICLE 501 - CLASS 1, DIVISION 2 LOCATIONS
2. ALL CONTROL PANELS TO BE NEMA 3R ENCLOSURES
3. ALL SHIELDED WIRES SHALL BE GROUNDED
4. INSTALL SIGNS, "DANGER HIGH VOLTAGE" AT PROMINENT LOCATIONS OF FRONT AND SIDES OF PANEL, IF APPLICABLE.
5. ENCLOSE ONE SET OF ELECTRICAL DRAWINGS INSIDE PANEL
6. IDENTIFYING ADHESIVE DECALS SHALL BE ATTACHED TO ALL MAJOR ELECTRICAL COMPONENTS
7. CONTROL PANELS SHALL BE U.L. LISTED
8. ALLCONTROL WIRES TO BE IDENTIFIED WITH WIRE NUMBER TAGS AT EACH END.

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0	100 PERCENT DESIGN SUBMITTAL	MMS	3/28/01

FINAL DESIGN SUBMITTAL

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PROJECT MANAGER MLS
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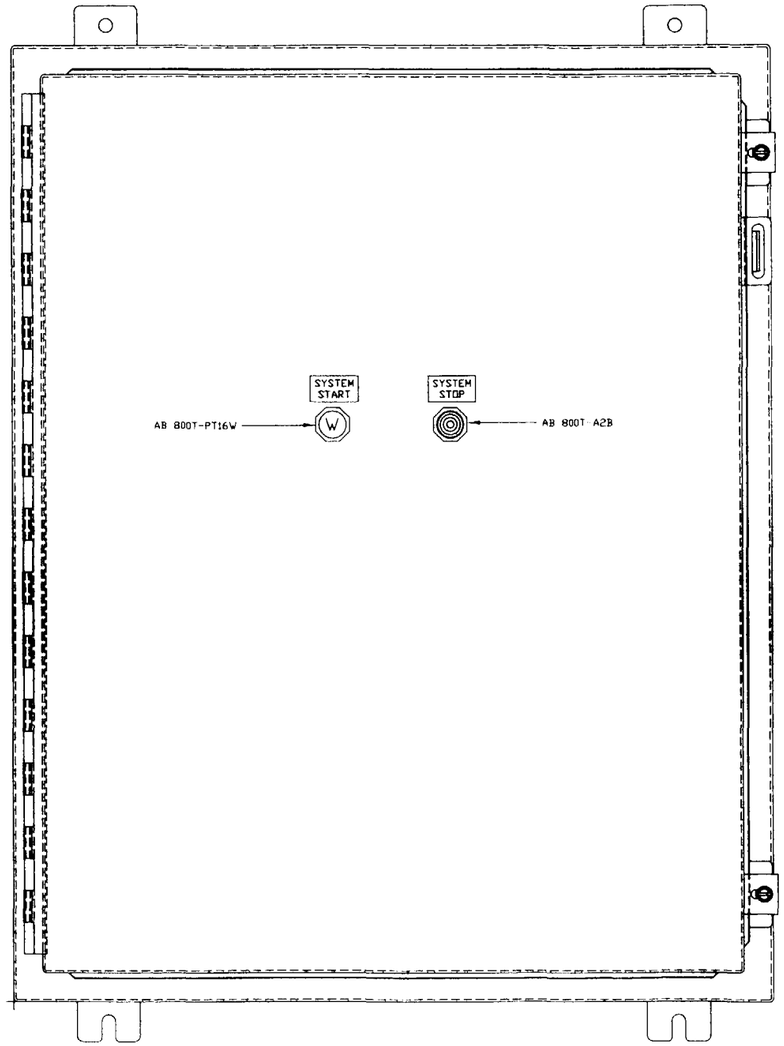
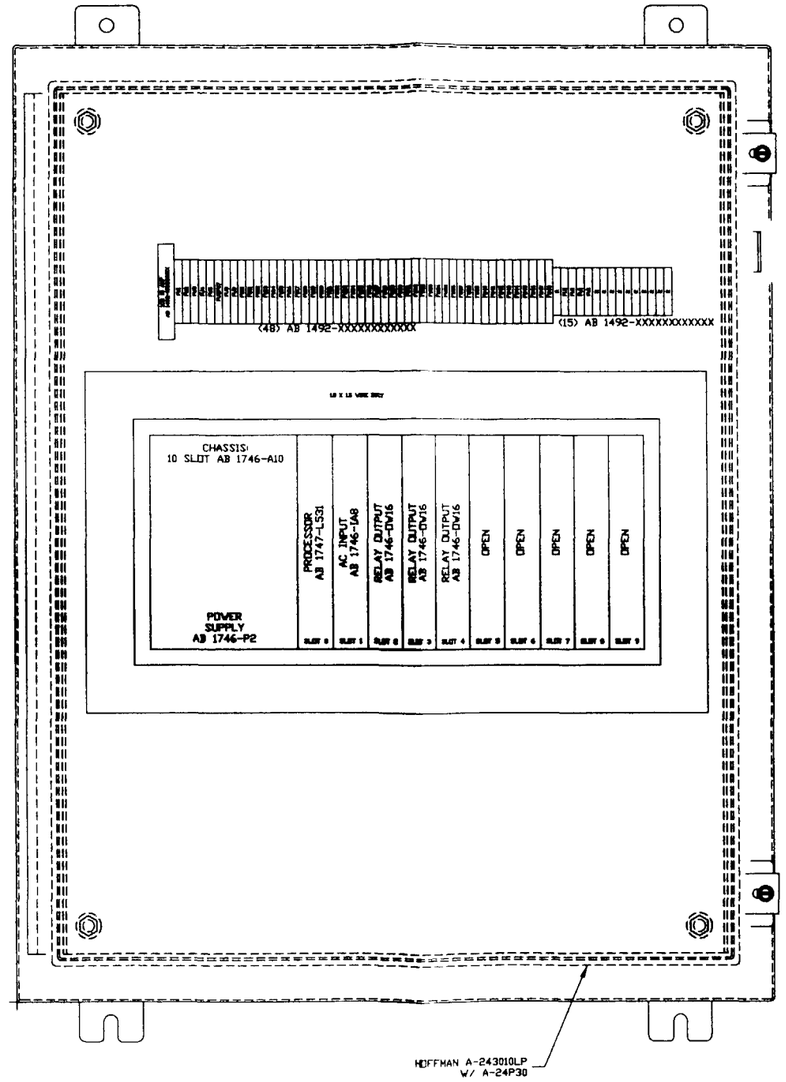
DNAPL RECOVERY CONTROL PANEL LAYOUT

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING E-01
SHEET 13 OF 16



VIEW SHOWN DOOR CLOSED



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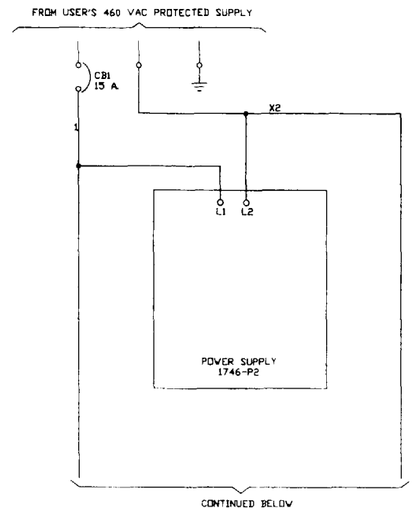
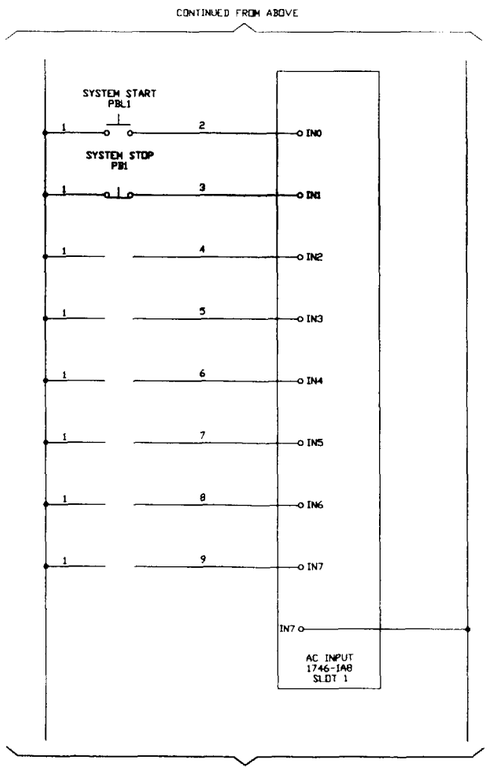
PROJECT MANAGER	MLS
DATE	4-10-01

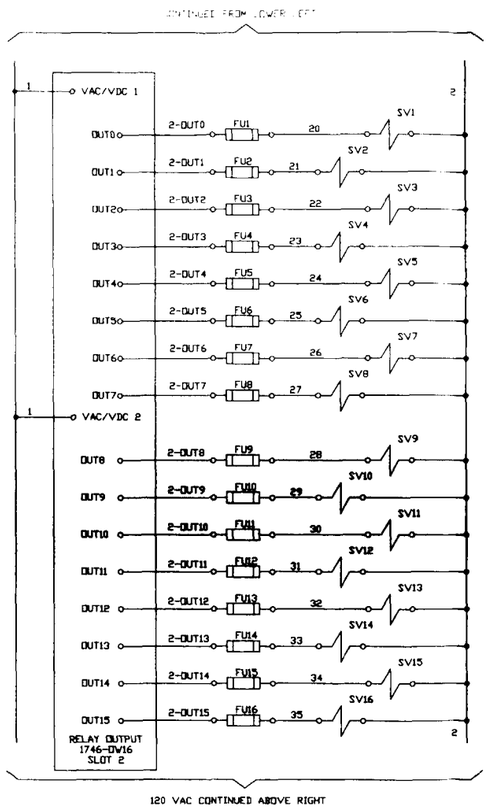
PLC CABINET LAYOUT

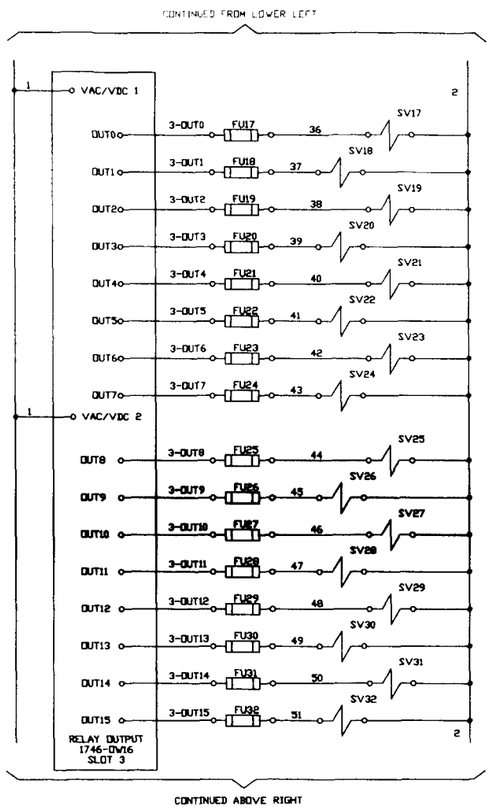
SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

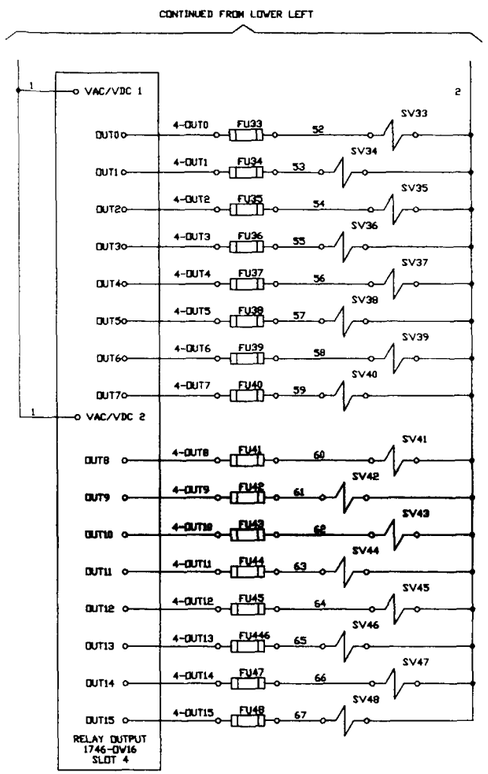
REVISION	0
PROJECT	38.8E06011.00
DRAWING	E-02
SHEET	14 OF 16











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90% DESIGN SUBMITTAL

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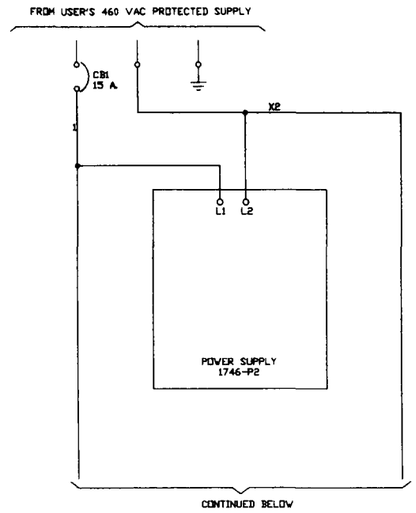
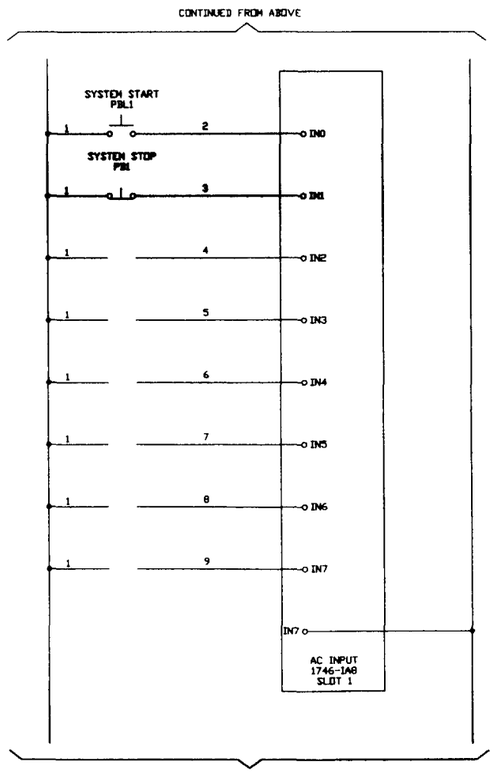
PEER REVIEWED	
PROJECT MANAGER	
DATE	9-22-00

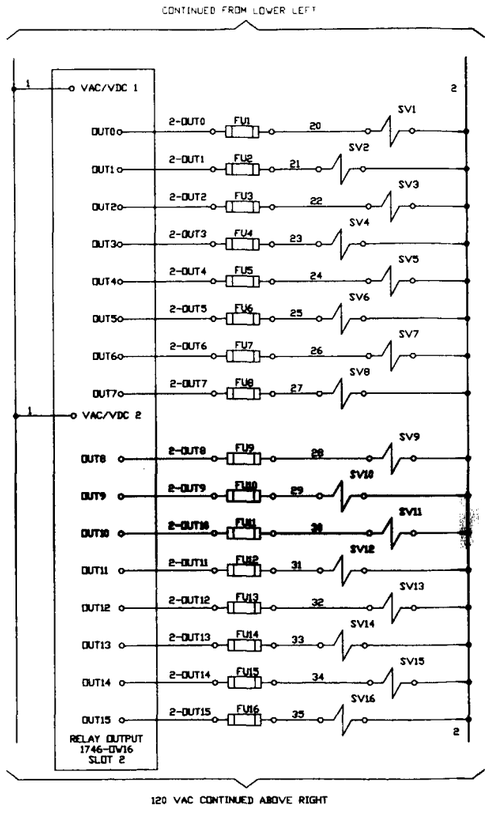
PLC WIRING DIAGRAM

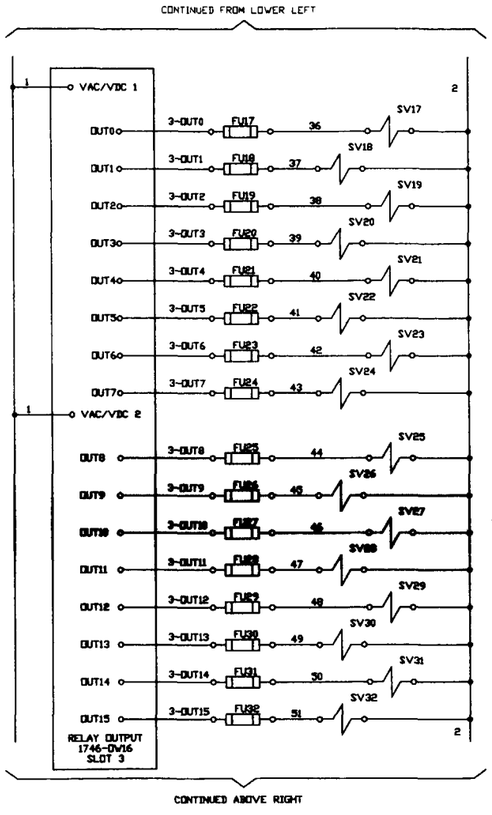
SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

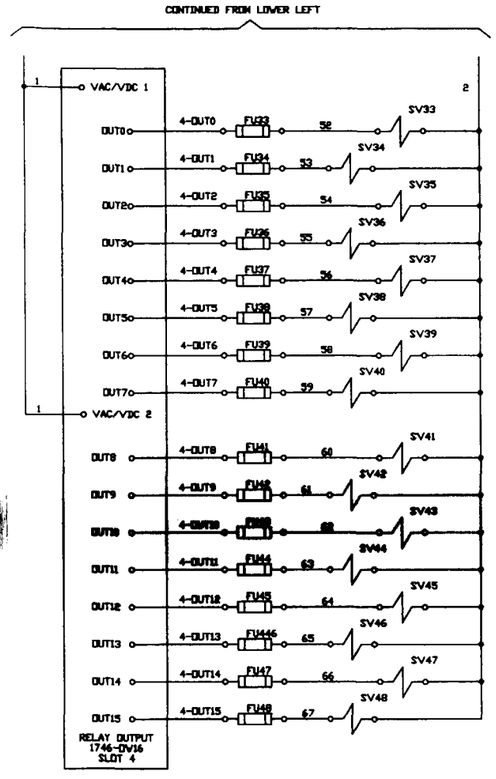
REVISION	0
PROJECT	38.8E06011.00
DRAWING	E-03
SHEET	15 OF 16











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90% DESIGN SUBMITTAL

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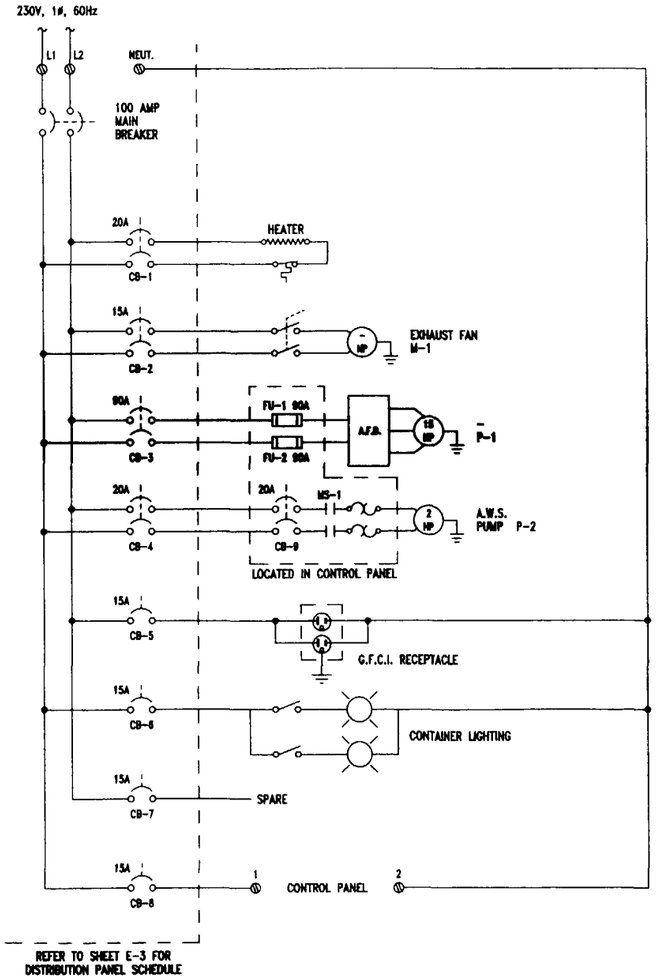
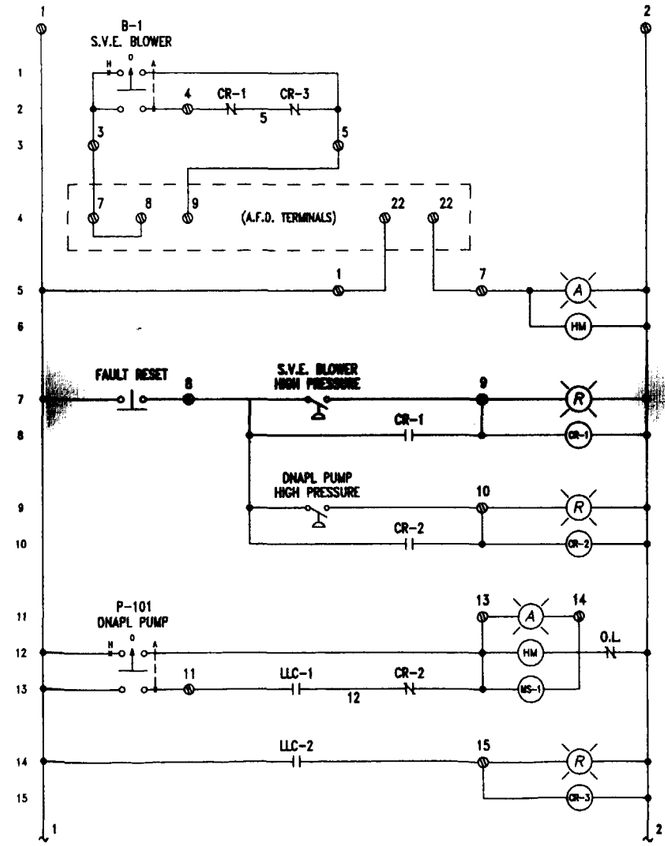
PROJECT MANAGER
DATE 9-22-00

PLC WIRING DIAGRAM

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING E-03
SHEET 15 OF 16





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EQUIPMENT BUILDING
CONTROL SCHEMATIC SCHEDULE

SOURCE CONTROL REMEDIAL COMPONENTS
DETREX CORPORATION FACILITY
ASHTABULA, OHIO

REVISION 0
PROJECT 38.8E06011.00
DRAWING E-04
SHEET 16 OF 16

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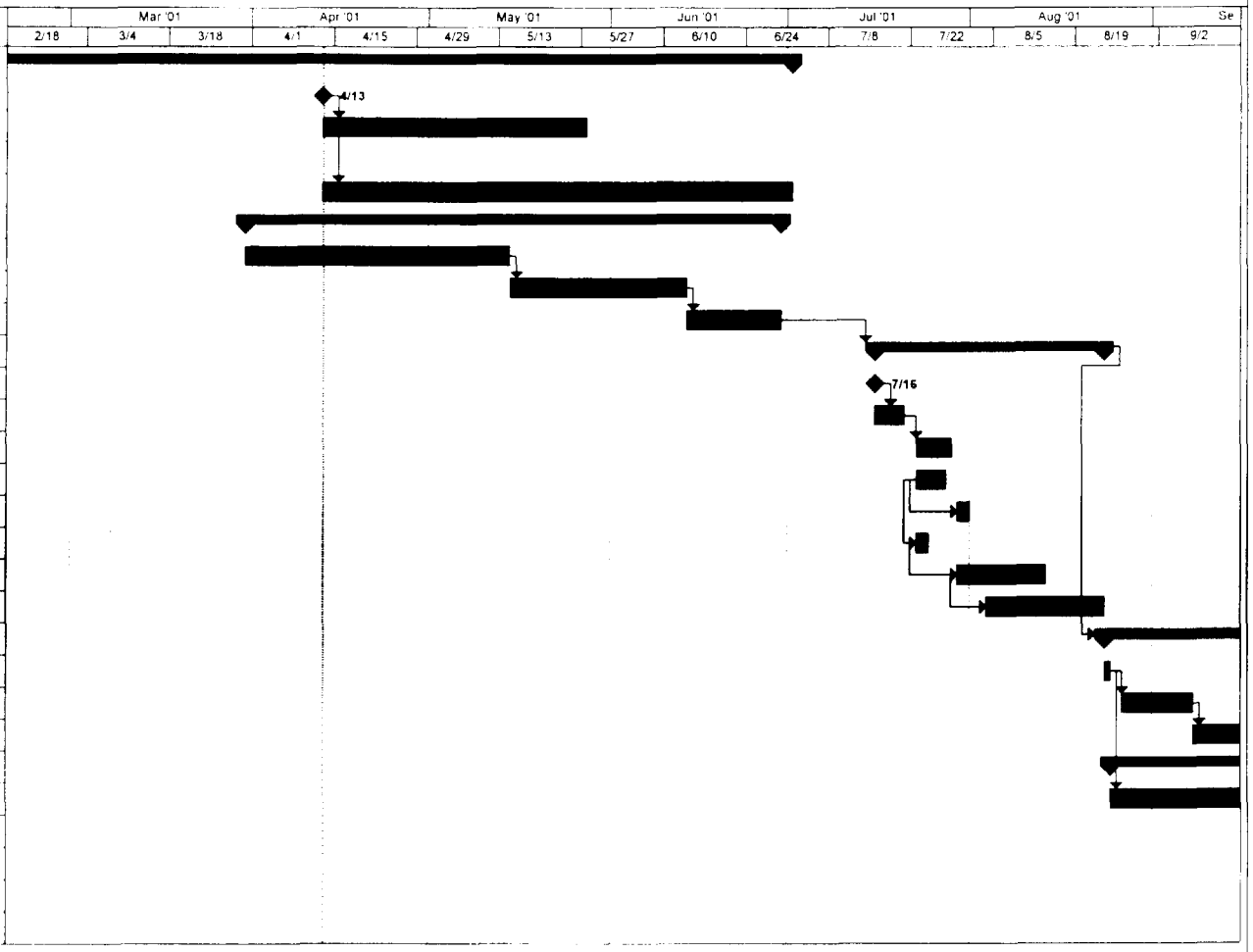
ATTACHMENT 1
SCHEDULE

Attachment 1
DNAPL Recovery System RD/RA Construction Schedule
Detrex Corporation - Ashtabula, Ohio

ID	Task Name	Duration	Start	Finish
1	**Remedial Design**	**181 days**	**Tue 1/2/01**	**Sun 7/1/01**
2	Submittal of 100% Design	0 days	Fri 4/13/01	Fri 4/13/01
3	Agency Review & Approval	45 days	Fri 4/13/01	Sun 5/27/01
4	RA Contracting	30 days	Tue 1/2/01	Wed 1/31/01
5	Equipment Procurement	80 days	Fri 4/13/01	Sun 7/1/01
6	**Remedial Action Plan**	**91 days**	**Sat 3/31/01**	**Fri 6/29/01**
7	Draft RA Work Plan	45 days	Sat 3/31/01	Mon 5/14/01
8	Agency Review & Comment	30 days	Tue 5/15/01	Wed 6/13/01
9	Final RA Work Plan	16 days	Thu 6/14/01	Fri 6/29/01
10	**RA Construction**	**39 days**	**Mon 7/16/01**	**Thu 8/23/01**
11	Pre-Construction Meeting	0 days	Mon 7/16/01	Mon 7/16/01
12	Mobilization & Site Preparation	5 days	Mon 7/16/01	Fri 7/20/01
13	Installation of Recovery Wells*	6 days	Mon 7/23/01	Sat 7/28/01
14	Building Pad & Foundation	5 days	Mon 7/23/01	Fri 7/27/01
15	Spotting of Equipment Building	2 days	Mon 7/30/01	Tue 7/31/01
16	Spotting of Pump Houses	2 days	Mon 7/23/01	Tue 7/24/01
17	Plumbing	15 days	Mon 7/30/01	Mon 8/13/01
18	Electrical	20 days	Sat 8/4/01	Thu 8/23/01
19	**Operation & Maintenance**	**745 days**	**Fri 8/24/01**	**Sun 9/7/03**
20	System Start-Up	1 day	Fri 8/24/01	Fri 8/24/01
21	Performance Optimization	12 days	Mon 8/27/01	Fri 9/7/01
22	Routine O&M, Monitoring	730 days	Sat 9/8/01	Sun 9/7/03
23	**Evaluation & Upgrade**	**725 days**	**Sat 8/25/01**	**Tue 8/19/03**
24	1-Year Performance Monitoring	365 days	Sat 8/25/01	Sat 8/24/02
25	Phase II 60% Design	90 days	Sun 8/25/02	Fri 11/22/02
26	Performance Monitoring Report	0 days	Fri 11/22/02	Fri 11/22/02
27	Phase II Review and Response	180 days	Sat 11/23/02	Wed 5/21/03
28	Phase II Construction	90 days	Thu 5/22/03	Tue 8/19/03



Project: SCHED1
Date: Fri 4/13/01

Task — Milestone — Rolled Up Split — External Tasks
Split — Summary — Rolled Up Milestone — Project Summary
Progress — Rolled Up Task — Rolled Up Progress

* - TASK MAY BE COMPLETED PRIOR TO COMPLETION OF DESIGN

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ATTACHMENT 2
COST ESTIMATE

ATTACHMENT 2 **SUMMARY OF ESTIMATED COSTS**
DETREX CORPORATION - ASHTABULA, OHIO
DNAPL RECOVERY PILOT-SCALE SYSTEM

GENERAL RESPONSE: CONTAINMENT, COLLECTION, TREATMENT AND DISPOSAL

PREPARED BY: URS CORPORATION

CONSTRUCTION ITEMS	QUANTITY	UNITS	UNIT PRICE	RAW COST	LEVEL OF SAFETY	COST FACTOR	TOTAL COST
1) Vacuum Enhanced Extraction Wells	12	wells	$2,000	$24,000	C	1.3	$31,200
2) Disposal of Well Cuttings (Off-Site Incineration)	10	tons	$900	$9,000	C	1.3	$11,700
3) DNAPL Water Separator	1	lumpsum	$8,000	$8,000	D	1	$8,000
4) Secondarily-Contained DNAPL Holding Tank	1	lumpsum	$5,000	$5,000	D	1	$5,000
5) Building w/Pad, SVE System, Compressor, etc.	1	lumpsum	$110,000	$110,000	D	1	$110,000
6) Satellite Pump Enclosures w/Heaters	2	each	$1,500	$3,000	D	1	$3,000
7) Air Diaphragm DNAPL Extraction Pumps	2	each	$1,500	$3,000	D	1	$3,000
8) Vapor Phase Treatment (Activated Carbon)	3	each	$4,000	$12,000	N/A	1	$12,000
9) Mechanical Equipment and Installation	1	lumpsum	$60,000	$60,000	D	1	$60,000
10) Electrical and Controls	1	lumpsum	$50,000	$50,000	D	1	$50,000
CONSTRUCTION ITEMS COST (INCLUDING DISPOSAL)							$293,900

ADDITIONAL CONSTRUCTION AND CONTINGENCY COSTS	PERCENTAGE OF CONSTRUCTION COST	COST
CONSTRUCTION ITEMS COST (INCLUDING PROTECTION):		$293,900
ADDITIONAL CONSTRUCTION COST:		
HEALTH AND SAFETY CONTINGENCY	1	$2,900
CONSTRUCTION CONTINGENCY	10	$29,400
CONSTRUCTION OVERSIGHT	5	$14,700
CONSTRUCTION TOTAL		$340,900
SUPPORT COSTS:		
ENGINEERING AND DESIGN	7	$20,600
PERMITTING AND LEGAL	1	$2,900
SERVICES DURING CONSTRUCTION	7	$20,600
SUPPORT COST TOTAL		$44,100
TOTAL TECHNOLOGY CAPITAL COST		**$385,000**

OPERATION AND MAINTENANCE (O&M) ITEMS	QUANTITY	UNITS	UNIT PRICE	RAW COST	LEVEL OF SAFETY	COST FACTOR	YEARLY COST
1) Parts, Electricity, Service for DNAPL Recovery System	12	month	$3,500	$42,000	D	1	$42,000
2) Weekly Inspections, including Sampling, etc.	52	per year	$200	$10,400	D	1	$10,400
3) Annual Sampling (System Performance)	64	hrs	$75	$4,800	C	1.3	$6,240
4) Laboratory Analysis costs (VOCs, SVOCs)	12	samples	$525	$6,300	D	1	$6,300
5) Incremental O&M Costs for Existing Water Treatment System (e.g. more frequent carbon replacement)	1	lumpsum	$20,000	$20,000	D	1	$20,000
6) O&M for Vapor Phase Treatment	1	lumpsum	$20,000	$20,000	D	1	$20,000
7) Groundwater Monitoring (8 Wells; VOCs, SVOCs, Duplicate & Blank)	20	samples	$600	$12,000	D	1	$12,000
8) DNAPL Disposal	4000	gallons	$7.00	$28,000	D	1	$28,000
9) Reporting	1	lumpsum	$25,000	$25,000	D	1	$25,000
TOTAL TECHNOLOGY O&M YEARLY COST							$169,900
REMEDIAL ALTERNATIVE SUBTOTAL (YEAR 1) -							**$554,900**
TOTAL TECHNOLOGY O&M PRESENT WORTH (5 % & 5 YEARS)							$735,600
REMEDIAL ALTERNATIVE SUBTOTAL (YEAR 5) -							**$1,120,600**
TOTAL TECHNOLOGY O&M PRESENT WORTH (5 % & 10 YEARS)							$1,311,900
REMEDIAL ALTERNATIVE SUBTOTAL (YEAR 10)-							**$1,696,900**
TOTAL TECHNOLOGY O&M PRESENT WORTH (5 % & 30 YEARS)							$2,611,800
REMEDIAL ALTERNATIVE SUBTOTAL (YEAR 30) -							**$2,996,800**

ATTACHMENT 3
CONSTRUCTION QA PLAN

Attachment 3
Draft Construction Quality Assurance Plan
Detrex DNAPL Recovery Remedial Action

The Construction Quality Assurance Plan (CQAP) for the Detrex Corporation DNAPL Recovery System Remedial Action (RA) will provide systematic procedures to verify and document that design and regulatory requirements are properly implemented during the RA. This document will be submitted in the near future under separate cover.